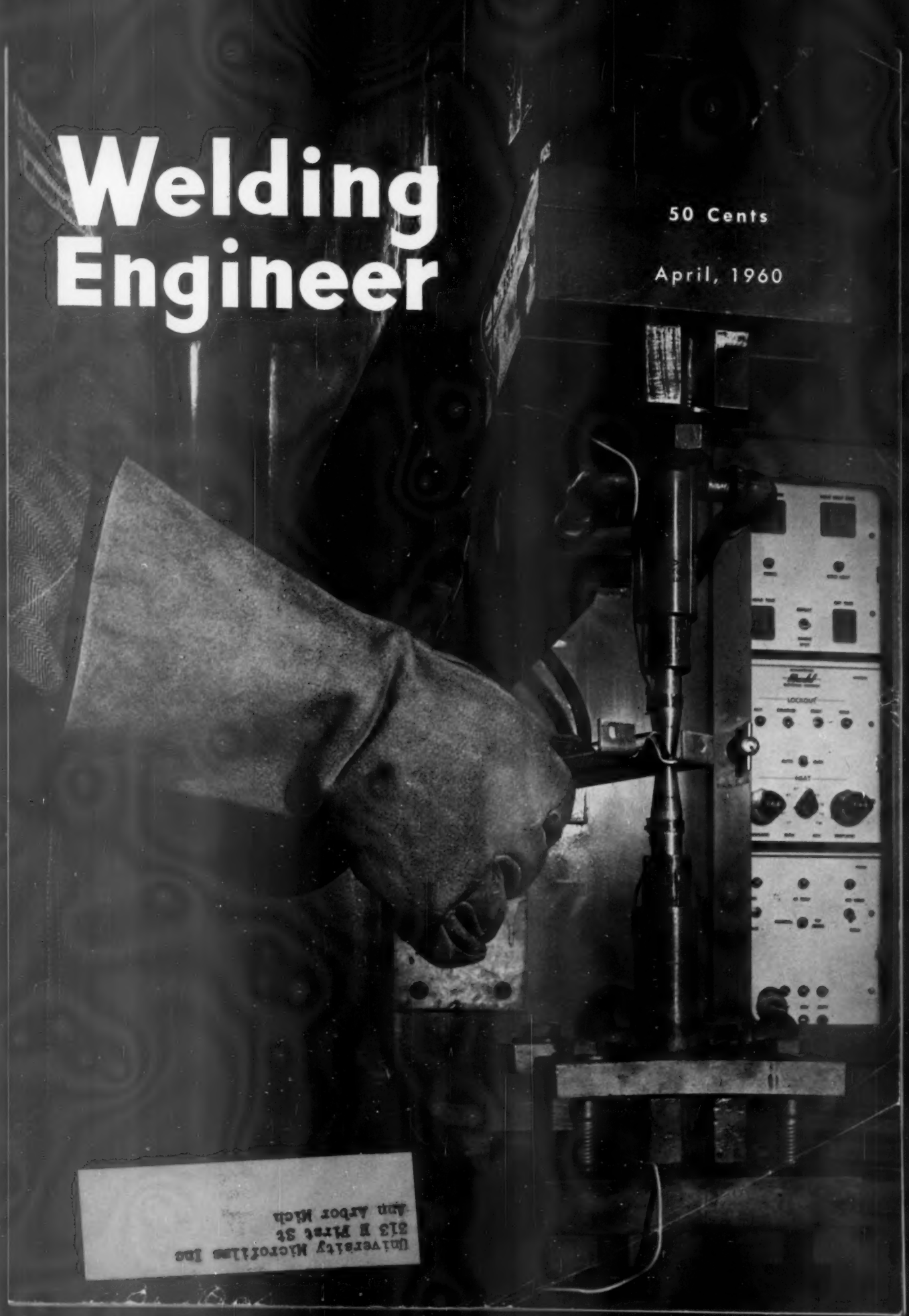
Welding Engineer

50 Cents

April, 1960



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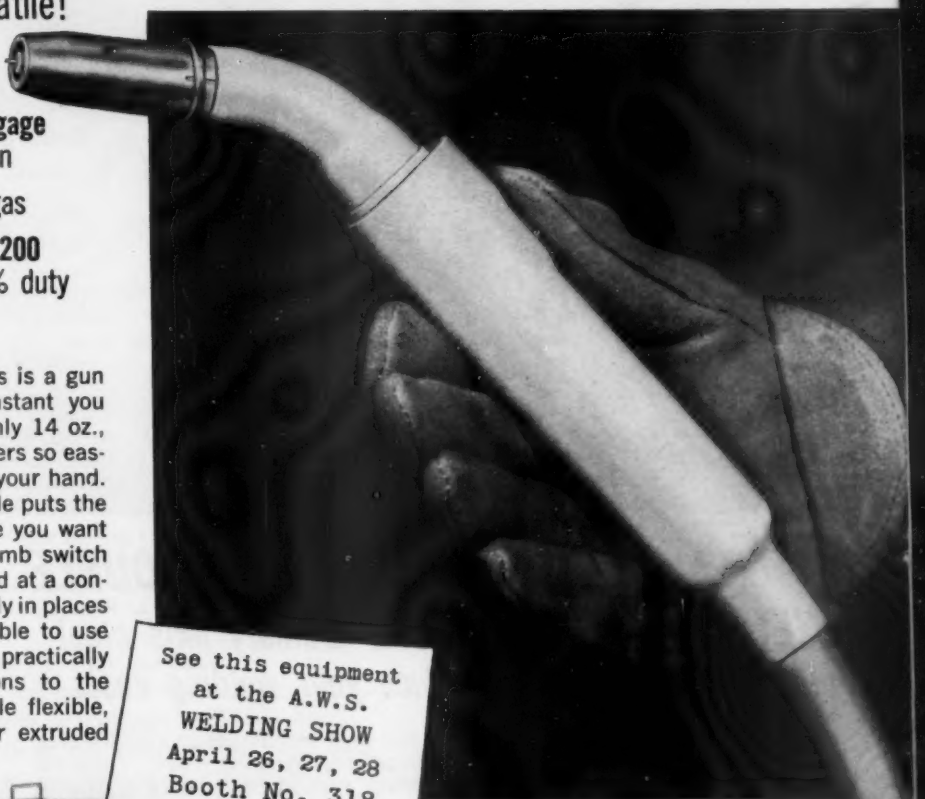
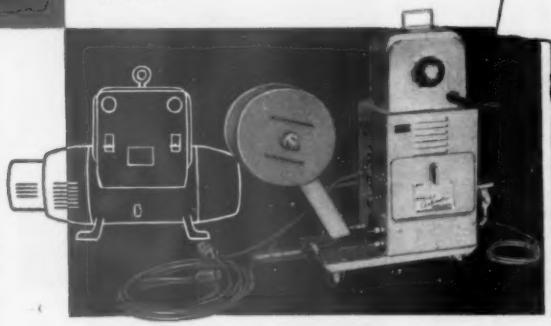


See this equipment at the A.W.S. WELDING SHOW April 26, 27, 28 Booth No. 318



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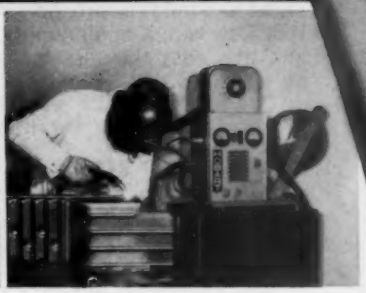

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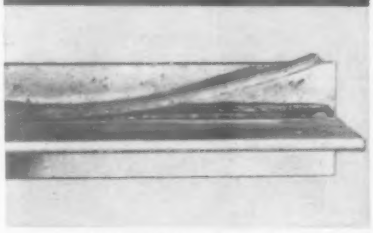
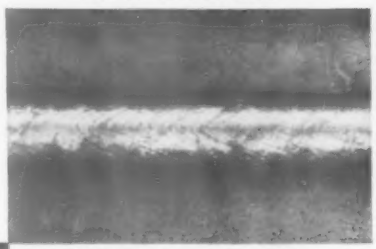


SELF REMOVING SLAG



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HOBART WELDERS · ELECTRODES

VOL. 45—No. 4

Welding Engineer

The magazine of joining and severing of materials

This is welding: April, 1960

Cover photo . . . depicts spot welding tests carried on with Budd Co.'s feedback control, designed to obtain correct fusion temperatures within each weld.

How to weld T-1 steel

AWS meeting, show expected to draw 25,000 persons 35
If you count yourself among the number, this run-down of what to expect in the City of the Angels will be both helpful and interesting.

How to weld T-1 steel 38
In this special issue, *WE* presents another article in a series on welding the high-strength and exotic metals. On subsequent pages are six application stories complementing this definitive report on T-1 steel.
★ (For a reprint of this article, circle number 250.)

Do you have a true picture of fabrication costs? 56
Executives (and others) may be jolted from their ivory towers when they read what author **Bela Ronay** offers as his solutions to some of today's shop practices.

Open-web steel frames cut building costs 76
Substituting rail steel for mild steel, a Wisconsin firm realized a substantial weight and cost savings when fabricating its open-web frames. **Fred E. Theiler** and **A. H. Marks** report on the firm's production procedures.

Aluminum piping for natural gas Mig, Tig welded 94
Getting another hand-hold in what was once the exclusive territory of steel, two aluminum pipelines were installed in Louisiana to transport natural gas. Mig and Tig welding played supporting roles.

Also in this issue:

Hose reel provides efficiency, economy 58
Tig gives an all-copper weld for motors 60
Hardfacing aid to coal mining 64
Mig welding helps build swimming pool 75
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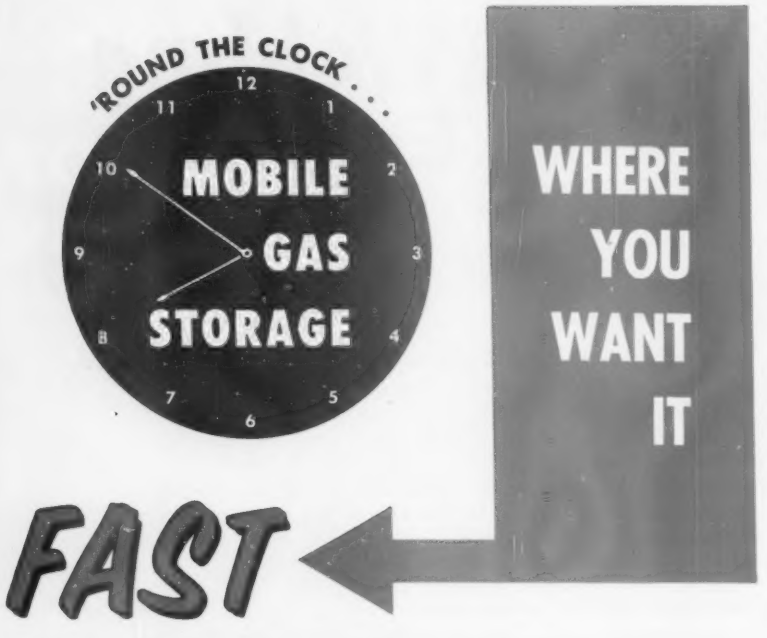

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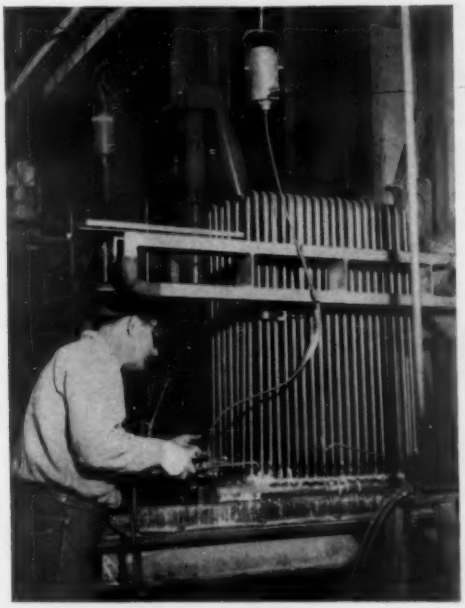
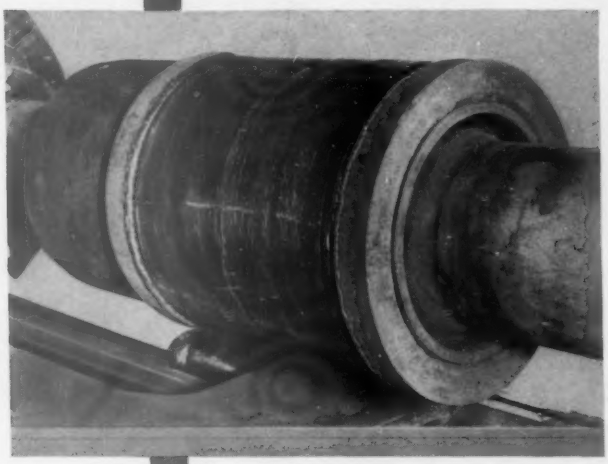
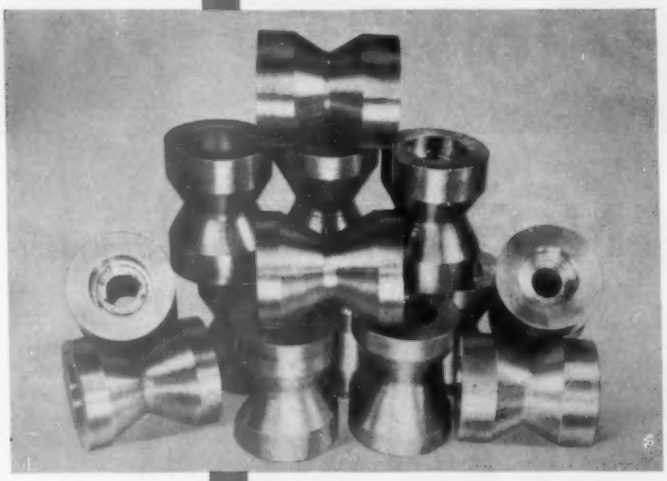
These are... COAST ALLOYS AT WORK







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NEWS

Airline completes welding facility

After two years in the planning stage and construction time of 120 days, the $313,000 facility of Airline Welding and Engineering, Gardena, Calif., has been finished.

A two-story 8,000 sq ft section fronting the building is allocated for office, accounting, sales and engineering space and is so designed as to provide maximum security for government projects. The eastern half of the plant area contains facilities for production of welding and weld processing machinery.

In the southwest corner of the building, located at 15899 S. San Pedro St., is a welding research and development laboratory, dedicated to the development of production welding equipment and techniques for new exotic metals and alloys.

NEW facility for Airline Welding and Engineering, Gardena, Calif., covers 38,000 sq ft, cost $240,000 for construction alone.

Southwest metal show space being assigned

Exhibit space is now being allocated for the 2nd Southwestern Metal Exposition and Congress May 9-13 in Dallas, according to exposition manager Chester L. Wells.

Interest in the forthcoming show is high, says Allan Ray Putnam, managing director of the American Society for Metals. As evidence, he cites inquiries on displaying basic materials, machinery for fabricating and testing, and methods to improve production at reduced costs. One-hundred twenty metal-working firms already have arranged for representation.

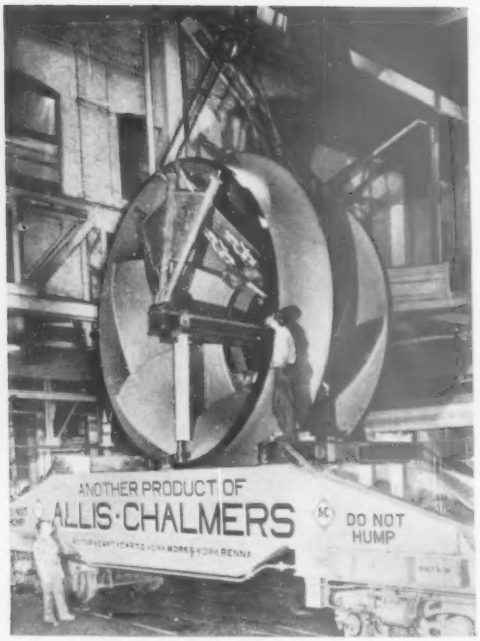
Eight one-half-day technical sessions are planned for the exposition, which will draw metal men from all parts of the nation. Among topics to be presented are new frontiers in welding and brazing—ultrasonic, electron beam, and CO_2 welding.

Many companies in the welding and allied fields are scheduled to exhibit, including: Magnaflux Corp., Turco Products, Inc., American Pullmax Co., Inc., Contour Marker Corp., Detroit Stamping Co., Oakite Products, Inc., Picker X-ray Corp., Sperry Products, Inc., and Budd Co.

Tempil Corp. offers metallurgical chart

A plastic laminated plaque dealing with ferrous metallurgy is being sold by Tempil Corp., New York City. The plaques, which attracted much interest when displayed at the Metal Show in Chicago in November, incorporate important metal-working zones in color. Change in grain size with temperature is schematically illustrated at the left of the chart and 24 fundamental metallurgical terms are defined at the right. The plaques cost $5.

MORE than 250 leaders of business and industry attended the sixth annual Midwest Welding Conference held in Chicago Feb. 3-4. The two-day conference, sponsored jointly by the Armour Research Foundation and the Chicago section of the American Welding Society, was especially concerned with the relatively new fields of welding in missiles and supersonic aircraft, as well as joining techniques used in nuclear power installations. At left, speakers for the first morning's session examine a honeycomb sandwich panel. They are, from left, Roy M. Gustafson, Bureau of Aeronautics; Thomas H. Burns, Thiokol Chemical Corp.; Joseph Melill, North American Aviation; and Allen F. Busto, Fansteel Metalurgical Corp. Picture at right shows Bela Ronay, welding consultant and frequent contributor to WE, registering.



MAMMOTH 50-ton runner rolls out of Allis-Chalmers yards for the Tuscarora pump power plant at Niagara Falls, N. Y. It was fabricated by welding the carbon-steel buckets to a cast crown and runner band. (For a detailed article on a similar application, see *Many advantages gained when redesigning turbine runners for welded fabrication*, WE, February, p. 32.)

COMING EVENTS

APRIL 4-7: 1960 Atomic Exposition, New York Coliseum, New York City.

APRIL 25-29: 41st Annual Convention, AWS, Biltmore Hotel, Los Angeles.

APRIL 26-28: AWS Exposition, Great Western Exhibit Center, Los Angeles.

MAY 5-7: NWSA 16th Annual National Convention, Palmer House, Chicago.

MAY 9-10: Annual Convention International Acetylene Assn., San Francisco.

MAY 9-13: 2nd Southwestern Metal Exposition and Congress, Sheraton-Dallas Hotel, Dallas.

MAY 25-26: Symposium on Refractory Metals and Alloys, McGregor Center, Wayne University, Detroit.

OCT. 13-15: AWS Western Welding Show, Exposition Hall, Santa Clara County Fair Ground, San Jose, Calif.

OCT. 17-21: 48th Annual Safety Congress, Chicago; 1960 Philadelphia Metal Show, Trade and Convention Center, Philadelphia.

Eutectic starts work on Swiss research center

Eutectic Welding Alloys Corp., Flushing, N.Y., and its European affiliates have initiated a huge research and development center in Lausanne, Switzerland.

Research work has begun in temporary quarters, pending completion of specially designed and engineered facilities later this year. Company president Rene D. Wasserman said several new developments growing out of the new research activities are being prepared for release in spring.

The firm will carry on a closely coordinated program for exchange of information between the European researchers and Eutectic in this country. The new facilities are under the direction of a man who has associated for some years with leading European electrode manufacturers and metallurgical companies, the firm said.

Thirty attend Lincoln design seminar

Lincoln Electric Co.'s 39th design seminar, recently completed, was attended by 30 engineers from various industries in the United States and Canada.

Two types of seminars, — one for structures and the other for machinery, were arranged to focus on what welded design can accomplish in improving performance and reducing costs.

Subjects included design of typical machine members, design of joints and welds; and fabricating methods and selection. The next scheduled seminar is April 11-15, on structures.

Hobart schedules summer refresher course

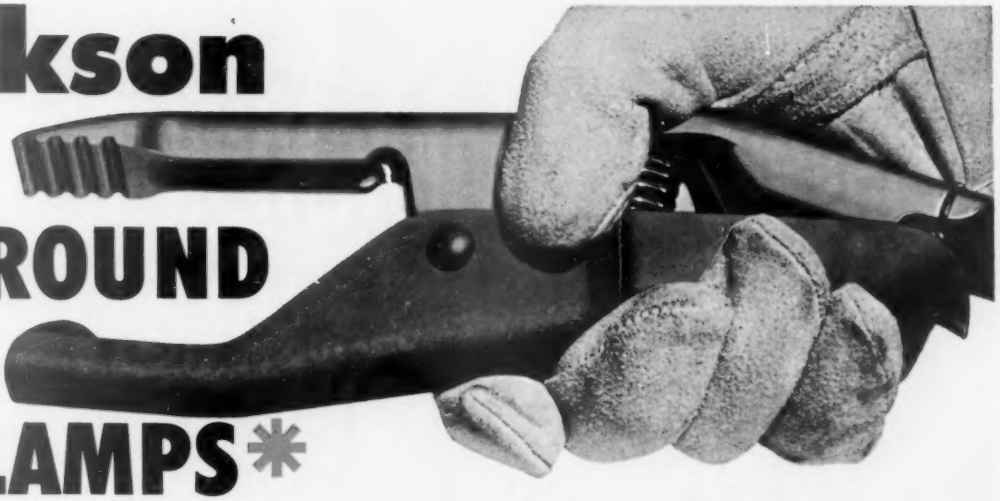
The Hobart Welding School Summer Refresher Course for teachers is scheduled for the weeks of June 13, June 27, July 11, July 25, Aug. 8, and Aug. 22.

Daily schedules at the Troy, Ohio, school will run from 8 a.m. to 4:50 p.m. and will include such topics as current adjusting, arc striking, selecting electrode sizes, sheet metal welds, fillet welds, stainless steel and cast iron welding, oxyacetylene brazing, and flame cutting. The sessions will include demonstrations, films, and discussion periods.

(*Continued on page* 108)

FULLY automatic boom manipulator type fusion welders built by Sciaky Bros., Inc., Chicago, will be used to weld high heat resistant, heat-treatable alloys. Here operator observes a weld in process by means of a TV closed circuit monitor. Camera is at extreme end of boom.

Jackson GROUND CLAMPS*



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* Jackson Ground Clamps work easily and efficiently. One end fits the hand, with finger-grooved lower tong. Proper placement—current-carrying upper tong on top where you're sure of good contact—is natural and easy.

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† Jackson 'Quik-Trik' Cable Connectors have streamlined Neoprene rubber insulators that lock out moisture, dirt, and don't catch on obstructions. Cable connects mechanically, or by soldering or brazing. The reduced tip diameter on the tapered plug takes hard knocks without forming a burr that will interfere with the mating of the halves.

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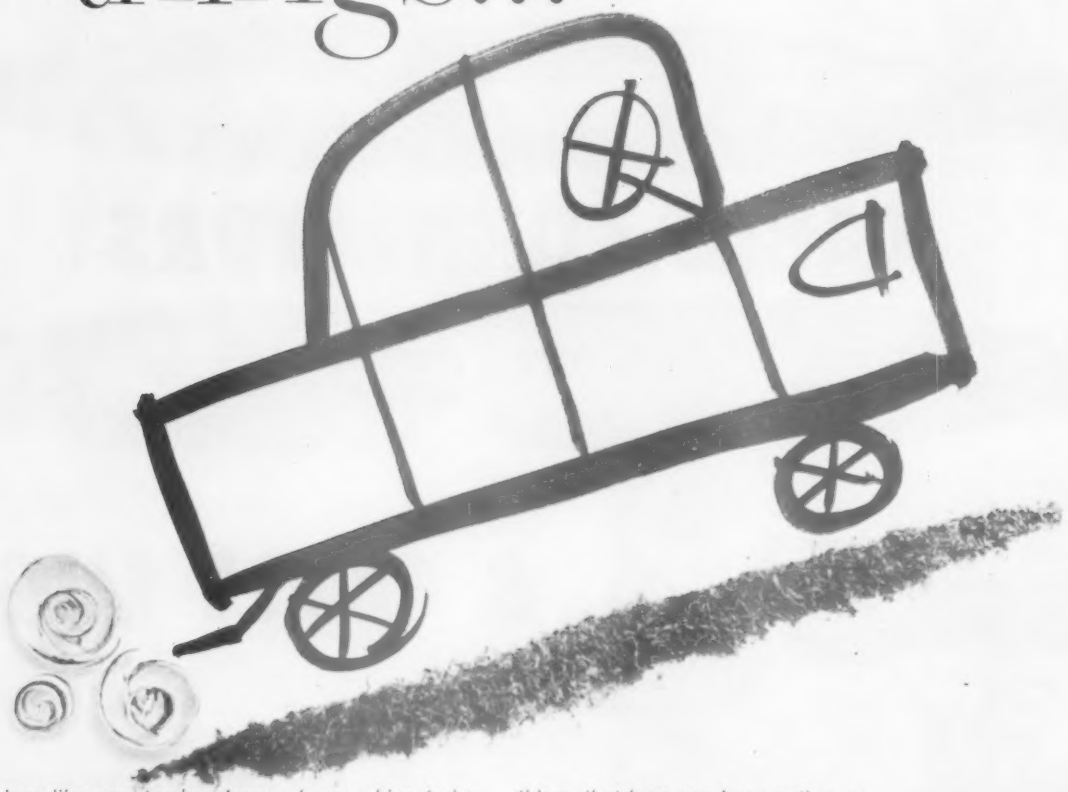
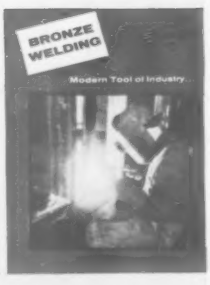


things like cars, trucks, planes—buses, ships, trains . . . things that keep our busy nation on the go. Whatever your application, in building or maintenance, a rod stamped "Bridgeport" gives dependable performance. Strict laboratory control assures uniform quality. Every Bridgeport alloy tins well . . . flows freely . . . produces dense, sound welds of high strength and ductility. They're available in standard rod sizes and lengths, and coils or spools for automatic equipment. Call your local distributor.



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(Below) The gouge and the gouging.

designed specifically for arc-air gouging, too!

relay circuit that prevents damage from the above normal current or above normal duty cycle.

You benefit with greater production and fewer repair bills. What's more, you have a dual-purpose unit that can both weld and arc-air gouge, a welder you can count on to work whenever you need it.

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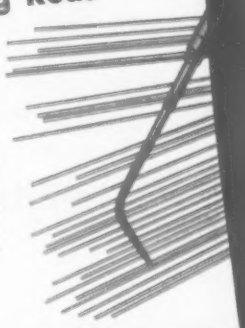

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Produced to meet exact specifications. Machining to close tolerances is a Titan specialty. Fast delivery assured.

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Hot-pressed from extruded stock to provide maximum density, high strength, long life, superior finished surface. Have thinner sections, closer tolerances and free machining advantages over sand castings.

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Write for folder describing Titan welding rod compositions and uses. It's free.

Serving the Welding Industry for 40 Years

WELDING ENGINEER

Your April, 1960 *Weld World*

As WE went to press, these were the industry's latest developments:

. . Ampco Metal, Inc., Milwaukee, is expanding its West Coast activities. It has purchased the former A. O. Smith foundry at Huntington Park, Calif., and will move from its present plant at Burbank, which will be sold. The bronze-alloy producer will gain 50% more floor space in the move. A new office building is planned for Huntington Park facility.

. . A new corporation, to be known as Progressive Welder & Machine Co., has been formed as a result of consolidation of all Progressive Welder properties. The action follows settlement of the estate of the late Fred Johnson, founder of the firm. Corporate offices are at 3070 East Outer Drive, Detroit.

. . After record sales and earnings in 1959, Bridgeport Brass Co., Bridgeport, Conn., has adopted a long-range expansion and plant improvement program. The expansion is designed to improve even further the firm's standing in its field. Bridgeport is actively engaged in working with, and developing more uses for, many of the "exotic" metals.

. . Triplett Barton, Inc., Burbank, Calif., manufacturer of portable industrial X-ray equipment, has been acquired by Howe Sound Co. T&B's products will be distributed through the sales organization of Sperry Products Co., Danbury, Conn., another Howe division.

. . National Welding Supply Association, Philadelphia, reports 1959 sales of its members increased 17% over the previous year. Meanwhile, Resistance Welder Manufacturers' Association announced that January figures for new business for its members are the highest for any one month in almost three years. January orders are 17% ahead of December and reflect a 36% increase over the same month in 1959.

. . Welding show in Los Angeles this month promises to be another of those "best yet" affairs. Record number of exhibitors is likely, and record number of visitors is expected – AWS is predicting attendance of about 25,000 persons for show and convention.

. . Linde Co., New York City, is building a Ribbonrail welding plant at Harrisburg, Pa., near the Steelton mill of Bethlehem Steel Co. Operated by Linde, it will produce continuous-welded rail on a contract basis for the Pennsylvania Railroad and other lines.

It's easy on the welder
It's flexible . . it's tough

Yes, Belden Welding Cable is "easy on the welder." It's engineered and manufactured to be extremely pliable, limp and flexible. Result: more production . . better quality . . lower costs.

And Belden Welding Cable is rugged . . rough and ready for the most severe conditions of abrasion, impact, as well as exposure to heat, cold, and oil.

Belden has a welding cable engineered for every possible welding requirement . . Oil Tempered Rubber Jacketed . . Neoprene Jacketed . . HVF Vinyl Plastic Jacketed . . Whip Lead, Super-flexible and Neoprene Jacketed . . Neocote colors for identification . . Rubber Jacketed Welder Supply Cords.

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Belden Welding Cable comes in many ready-to-use package lengths.

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18-1-0

Linde leads
in modern methods
for joining metals

1936 - Unionmelt welding
1943 - Heliarc welding
1947 - Unionmelt multi-
electrode welding
1949 - Heliarc spot welding
1950 - Sigma welding
1951 - Sigma spot welding
1955 - Heliarc cutting
1956 - Unionarc welding
1957 - Sigma short arc welding
1958 - Pilot Arc starting
1959 - Plasmarc processes

Look to the future with Linde

Linde has all
continuous electrode
welding processes

Linde has a complete
line of equipment for
all of these processes

BRAZE—HEAT—CUT—WELD

You're all set for the tough jobs

...WITH THIS #545 DOCKSON OUTFIT

#545 OUTFIT, right, is fast and versatile. Cuts up to 5" thick steel. Welding torch is ideal for light plate or heavy castings. Rigid one-piece silver soldered construction and long-life, special rubber, mixer sealing rings.

#600 OUTFIT, below, can weld up to 3/16" thickness and cut up to 1/2" thickness. A compact, lightweight Outfit suitable for all ordinary welding jobs in smaller shops.

Dockson Outfits are standard catalog items and replacement parts are available quickly when needed.

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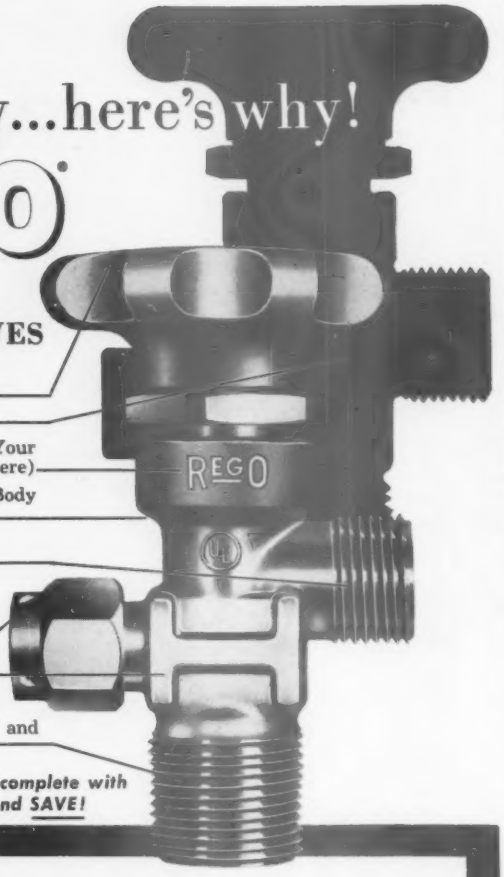

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30 YEARS AGO

(Taken from **Welding Engineer** of April, 1930)

—30 Years Ago—

E. C. Caluwaert, formerly with Smith Welding Equipment Corp., is now associated with Northwestern Mfg. Co., Milwaukee.

—30 Years Ago—

Harris Calorific Co., Cleveland, has appointed Virginia Welding Co., Charleston, W. Va., as sales agents. V. S. Rice, who is proprietor of the latter firm, has been engaged in the welding supply business for 14 years.

—30 Years Ago—

The Sutton-Garten Co., Indianapolis, Ind., welding engineers and contractors, have erected a new, modern welding plant at 401 W. Vermont St., which has been described as a "super job-welding shop."

—30 Years Ago—

The Lincoln Electric Co., Cleveland, has opened new branch offices in Saginaw, Mich.; Fort Wayne, Ind.; and Oil City, Pa. J. E. Luter heads the Saginaw office; D. H. Carver the Fort Wayne branch; and E. D. Anderson the Oil City office.

—30 Years Ago—

"Safe welds" and the scientific prediction of weld behavior were subjects of a talk by Robert Kinkead, consulting engineer, before the Cleveland Section of the American Welding Society.

—30 Years Ago—

D. L. Driscoll of Long Beach, Calif., has recently been placed in charge of management of the Superior Oil Well Equipment Co., located in the Signal oil field of southern California.

—30 Years Ago—

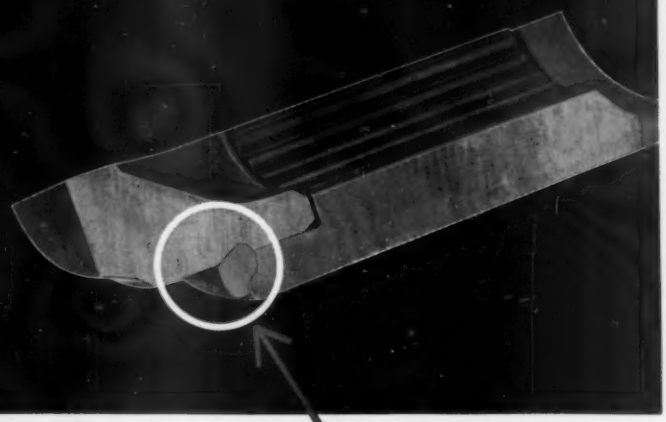
William J. Chesak has joined Modern Engineering Co., El Paso, Texas, distributors of welding equipment and supplies. The firm is under management of W. H. Miller.

—30 Years Ago—

By action of the Board of Directors of the American Welding Society, the Samuel Wylie Miller Medal, donated in 1927 by Mr. Miller for the period of his lifetime, has been established in perpetuity by the Society as a memorial to the donor.

NEW WIRE

WELDS TWO HIGH-CARBON RESULFURIZED STEELS



Now You Can Weld SAE 1141 to SAE 1151----with CO_2 and

PAGE A-S-18

The cutaway portion of a drive shaft shown above was produced on an automotive production line. It consists of two welded pieces of high-carbon, sulfur-bearing steel—SAE 1141 and SAE 1151. Note the clean metal in the weld.

Previously, it has been impractical to weld these grades of steel by inert gas or submerged arc methods. Pre-heat and post-heat normally were required resulting in the annealing of the pre-hardened sections of the steel.

New PAGE Analysis A-S-18 solves this problem. Using PAGE A-S-18, without pre-heat and post-heat, you can obtain a high-quality, non-porous weld on any free-machining steels in the SAE 1100 series, or on any .25 to .50 carbon steel. For instance, .35 carbon steel joints welded with A-S-18, using CO_2, produced tensile strength of 75/81,000 p.s.i.—yield strength of 55/61,000 p.s.i.—elongation of 24%.

PAGE A-S-18 may be an answer to your welding problem. Why not try it?

A portion of a drive shaft shows perfect weld around circumference, a result of high elongation of PAGE A-S-18. The weld was accomplished in two passes.

Let PAGE Help Solve Your Welding Problems

These Folders can help you

Write for:

Folder DH-402-C Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

When you bring your welding problems to PAGE, you get the benefit of over half a century of wire drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses —33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

PAGE wire packaging is designed to give you the utmost in convenient storage and handling, whether you require a 1# spool or a 1200# payoff-pallet. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located PAGE warehouses.

You will find it is "good business" to bring your problems to PAGE.

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- Maintenance costs cut—smooth surfaces clean easily, paint quickly.
- Eye appeal—no crevices, cracks or ridges. Modern appearance for industrial and medical applications.
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- Rugged construction that lasts. Hackney has spelled quality since 1902.
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- Complete range of sizes and shapes—from small medicals to 220's, 250's and 300's (cu. ft.).
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Letters . . .

Welding terminology

Sir: *New Milford, N. J.*

Your issue for February 1960 contained a letter by Mr. Cary of Hobart Bros. as to the credit for introducing the term "weldor." Permit me to add my own thoughts on this subject.

In every language the chief effort for proper usage is to make it abundantly clear what is meant to be conveyed. "Welder" and "weldor" do not differ very much, although to us, the applicators of the art of welding, the ending "*. . . or*" looks more like a misspelling and we are used to and like to be known as "welders."

What you and Mr. Cary should be thanked for is the idea of doing away with the depreciatory term "welding operator." However, when you are already trying to clairfy terminology, permit me to ask you to go all the way. You have realized, justly so, that we do not operate anything, except if we use automatic equipment, when we strike an arc or light a torch.

The application of welding in the shop, at least by experienced welders, is far from being automatic. It depends on personal effort, integrity, experience, and judgement.

By the same token, a "welder" as the term applied to a power source is not proper, since the machine or transformer does not weld at all. It just supplies the current necessary to the application, as selected for or by the man wielding the electrode. . .

I propose . . . using the terms "a-c welding generator, "d-c welding generator," "welding transformer," and "welding rectifier" in advertising and in technical literature. Then we "welders" can retain the honorable title, the term "weldor" can be tossed into oblivion and the great industry of welding will be richer for it.

Otto S. Leib
WeldEr

—WE will stick to "weldor."

Symbols error

Sir: *Lorain, Ohio.*

Would it be possible to obtain 50 to 100 copies of the article, "A guide to preheat", which appears in the February issue *WE*? This article provides an excellent background for this problem, and it

will be very helpful in the training program we are now carrying on with our old and new field engineers.

Incidentally . . . it appears that the symbol for magnesium has been substituted for the symbol for manganese in the first nine listings in the table.

R. C. Singleton
Gregory Industries, Inc.

Sir: *New York City*

Your February 1960 issue carries engineering data sheet #233 on page 35, and no doubt because of the similarity of the chemical symbols for manganese and magnesium, an obvious error has been made. Your chart for each type of steel shows an Mg content whereas Mn or manganese would be correct.

L. J. Anderson
Air Reduction Sales Co.

—You're right. The error was obvious. Reprints, however, will be correct.

Strip heaters

Sir: *Springfield, Ohio*

We read with interest in the February issue . . . an article entitled "A guide to preheat." Our interest centered on electrical strip heaters and the adaptation of same to odd shaped and contoured welding.

We would appreciate it if, at your earliest convenience, you would forward to us the name of the company that could furnish us with this type of equipment.

D. E. Eibe
Patton Mfg. Co., Inc

—The manufacturer is J. B. Nottingham & Co., Inc., 441 Lexington Ave., New York 17, N. Y.

Thanks for cover

Sir: *York, Pa.*

It was with much pleasure that I saw George Lark, a welder in the York works of Allis-Chalmers Mfg. Co., on the cover of the current issue of WE, and . . . my paper as a feature article.

Fritz M. Hessemer
Allis-Chalmers Mfg. Co.

Keeping current

Sir: *Belknap, Mont.*

I sure like your magazine, mainly the editorials. You tell of many teachers who still teach that riveting is the best way of fastening. I say that all teachers of any trade should be required to work for some construction company at least every other year; then they would never be more than a year behind the times . . . we see too much of that "behind the times" in so many college graduates. As one weldor told a young man who asked what was a good welding school, "Get some rods and a welder and learn by making mistakes; the fellow who wrote the book had to learn that way, and reading and practice is all you get in any school; you might as well save that money."

But I'll sure disagree with a lot of guys who write that overwelding is expensive. It may be to the company who half welds a machine, but how about the buyer who has to have the whole outfit rewelded? He's out both time and money . . . half my repair welding is to reweld some poorly welded joint broken in the weld metal. Keep giving those behind-the-times teachers hell.

Frank Tinker

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

The Most Advanced Line of Welding Aids Ever Produced for
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Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

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for Sims Cab Company

The perfect grinding wheel for the J. Frank Sims Cab Company of Rutland, Mass. would be both a lion and lamb; it would cut fast and grind smooth enough for painting. And in their constant effort to reach perfection, they've tried just about every wheel that's made.

The sheet metal cabs and other products they fabricate for the major tractor companies come out of the welding shop with a good many yards of welded seams that have to be ground down to a flat surface. The roughing operation must be fast and at the same time must leave a fairly good finish, thereby minimizing the time required for the final, more expensive surface-blending operation.

When Alden Maynard (of Bay State distributor Abrasives & Tools, Inc.,) first introduced Bay State's standard Blue Flash Raised Hub Disc Wheel at Sims Cab, it came closer to the ideal combination of speed with smooth finish than any competitive wheel . . . and it has maintained that superiority ever since. As Sims V. P. Ralph Johanson says: "We go by simple arithmetic. A wheel that cuts both grinding time *and* finishing time is going to cut costs, too . . . and every nickel we cut out of costs helps build us a profit. That's why the Blue Flash is our standard wheel."

Like Alden Maynard, your own Bay State distributor or direct representative is a trained abrasive specialist. His own experience is backed by one of the finest research and development facilities in the industry at Bay State's Westboro headquarters. So, whether your requirements call for a standard wheel or a special formulation, you can be sure of intelligent analysis and *practical* results from Bay State because . . . *better grinding at lower cost, that is our business.*

Sims V. P. Ralph Johanson & Operator Jack MacDonald examine finish on tractor cab weld seams after grinding with Bay State's Blue Flash Disc-Wheel.

Operator Jack MacDonald grinds weld beads off rounded corner of tractor cab at Sims Cab Co., using Bay State's standard Blue Flash Raised Hub Disc Wheel.

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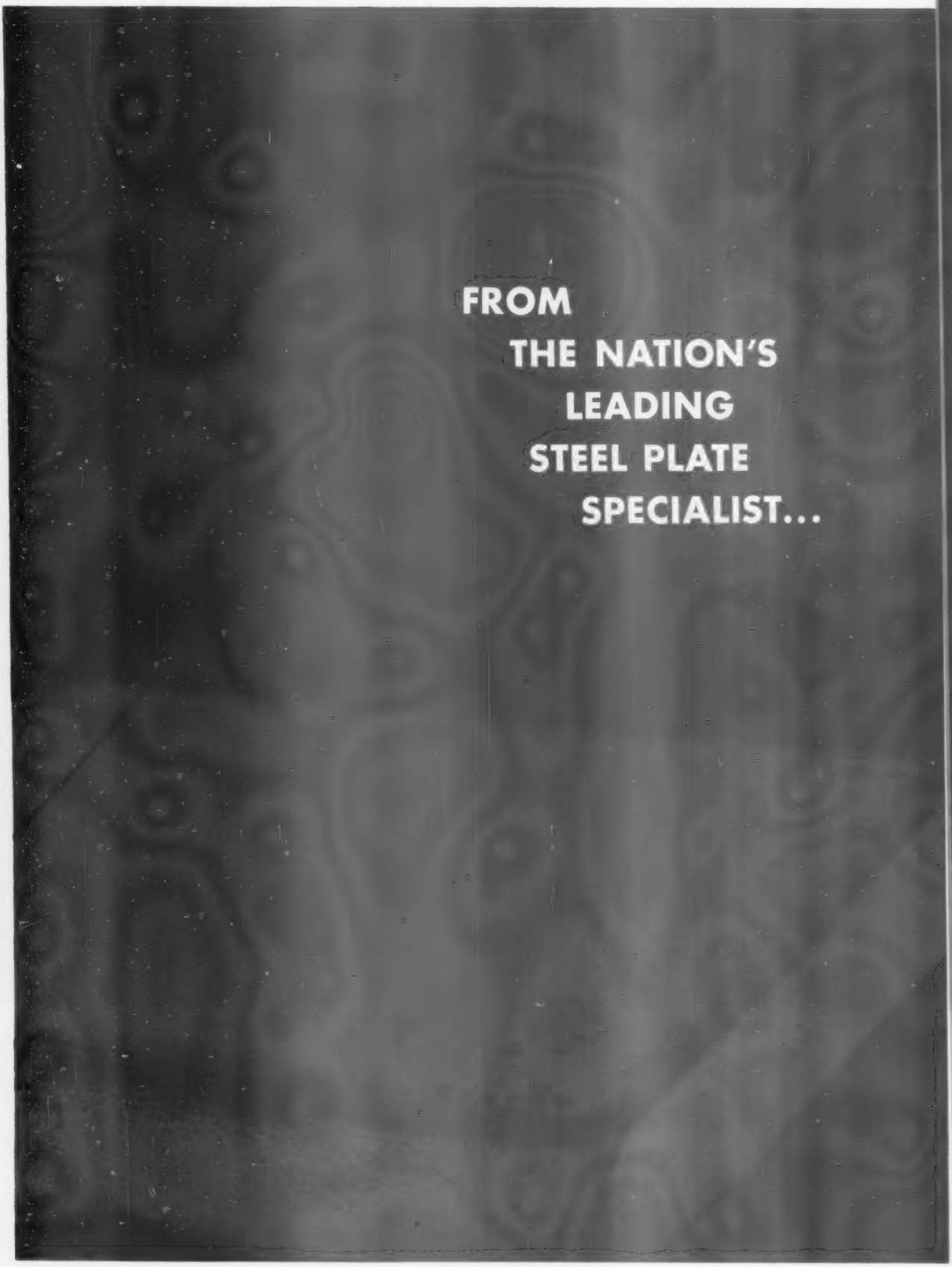
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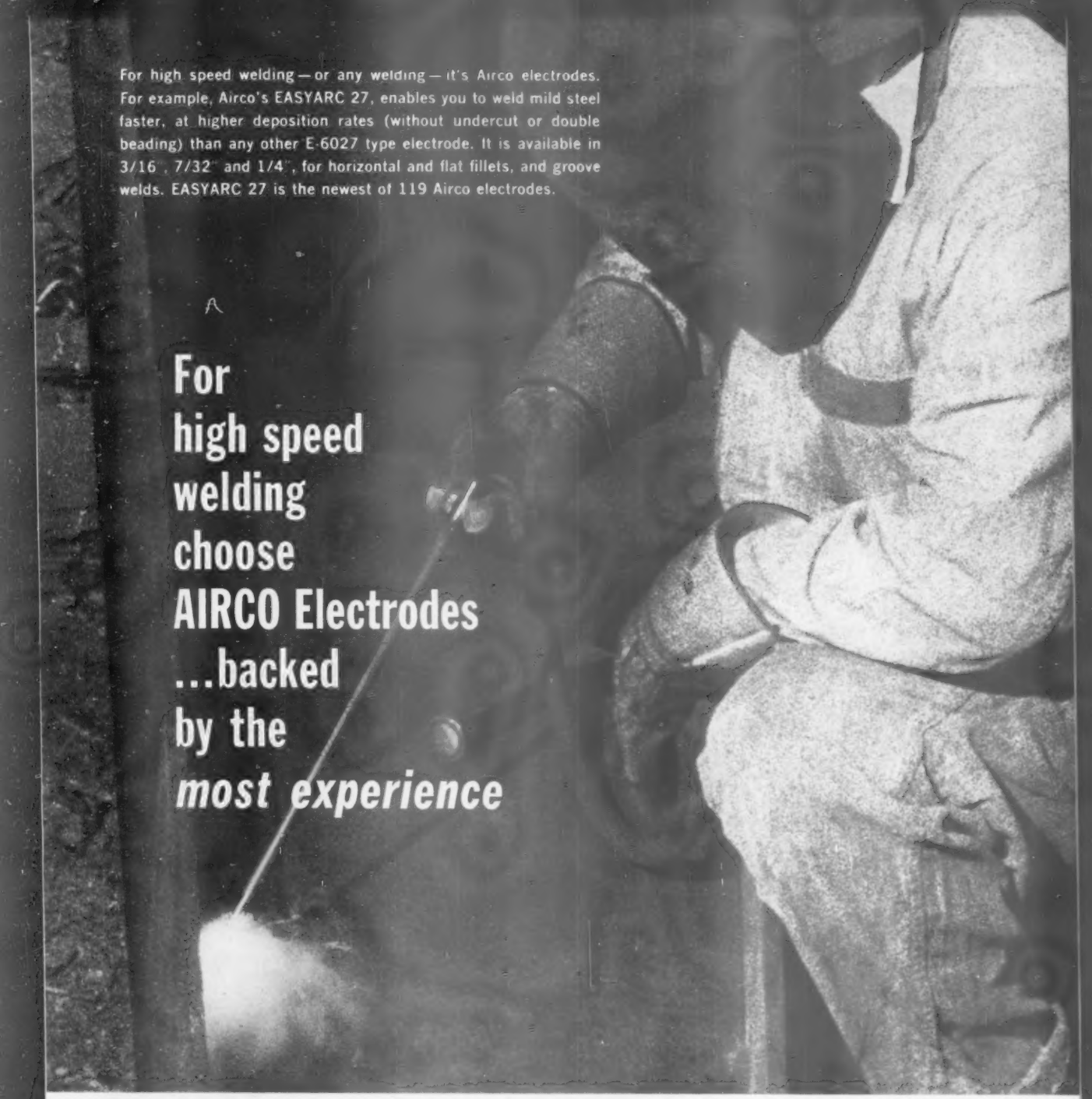
For high speed welding — or any welding — it's Airco electrodes. For example, Airco's EASYARC 27, enables you to weld mild steel faster, at higher deposition rates (without undercut or double beading) than any other E-6027 type electrode. It is available in 3/16", 7/32" and 1/4", for horizontal and flat fillets, and groove welds. EASYARC 27 is the newest of 119 Airco electrodes.
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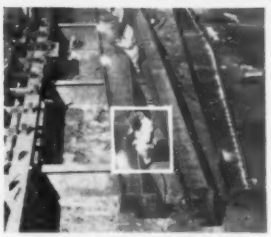

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For any electrode: stainless, mild steel, low alloy, low hydrogen, metal powder, aluminum, bronze, cast iron and hardfacing — phone your authorized Airco Distributor. Look in your Classified Telephone Directory under "Welding Equipment and Supplies" for the nearest Airco representative.

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BETWEEN PASSES

our new look

As most of you know, since the beginning of the year, WELDING ENGINEER again has been using editorial covers. But with this April issue, our new look goes well beyond the cover. We have changed type faces, narrowed both column widths, made greater use of color, and generally have attempted to make *WE* a more attractive package.

But the package is not the product . . . our product is our editorial content. For almost 45 years *WE* has been describing the latest developments in welding and their applications. *WE* will continue to do so.

We hope you like our new look. We feel it will help you in your reading—for that's the primary purpose in redesigning the package. The editors would be happy to hear your reactions. After all, we edit WELDING ENGINEER for you—the reader.

(Incidentally, our four-color cover this month is not the first ever used by *WE*. Back in June, 1954, we ran a four-color cover illustration of a welded water tower.)

more work to do

Everytime we begin to feel better (sometimes even a bit smug) because welding is getting more recognition, something comes up that makes us realize our job is far from finished.

We especially don't relish the job of reporting set-backs during this, the month devoted to promotion of welded products and welding. However, Roy McCauley, of Ohio State University's department of welding engineering, sends along an item recently published in a Milwaukee newspaper which cannot be ignored.

It seems Wisconsin's expressway commissioners and county engineers felt that bridges in the system should be bolted or riveted, while state highway engineers preferred welded design. An extra $2,500 was appropriated to revise plans for bridges originally to be welded.

The article concedes that welded structures are more attractive, but goes on to say that "experience has shown that it is difficult to get good welds in the field. Flaws are hard to detect . . . "

Monumental evidence to the contrary is the growing number of welded bridges that have been erected in recent years. As we said, our fight is far from finished.

education

It isn't often you hear of a company passing on tips to possible competitors. As editors who have been rebuffed more than once by fabricators because they were unwilling to divulge "confidential manufacturing practices," we were frankly surprised to learn from Ray Hoefler of Kaighin & Hughes, Inc., that his firm shared welding data with personnel from other industries in the Toledo area.

K & H's welding development and quality control department was established in the 40s to establish and qualify new procedures, control shop and field quality and introduce proper procedures in the field. Realizing that data collected by such a development department is of little value unless properly presented to design and construction personnel, periodic educational meetings are planned for engineering and management departments.

But to open such an affair to other industries is unheard of. However, to its everlasting credit, K & H did just that.

Ray, who is chief welding engineer, conducted the recent meeting, the subject of which was Tig (tungsten inert-gas) welding. Primary reason for opening it to outsiders—131 persons from 31 industries—was that there is limited data available on the subject.

We're not saying that any trade secrets were revealed, but the purpose of this sharing of information was to prevent duplication of effort in Tig development . . . and such prevention leads to a growth of *quality* welding.

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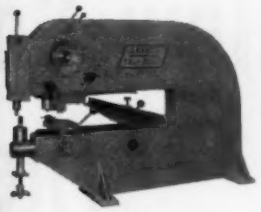

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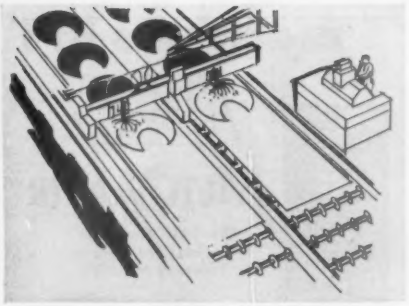
See us in Detroit
Booth 846 ASTME Show



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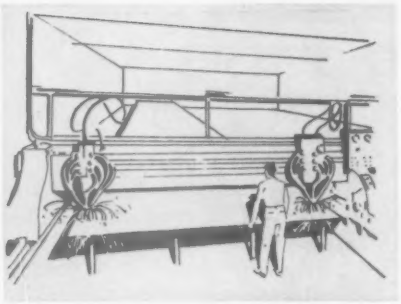
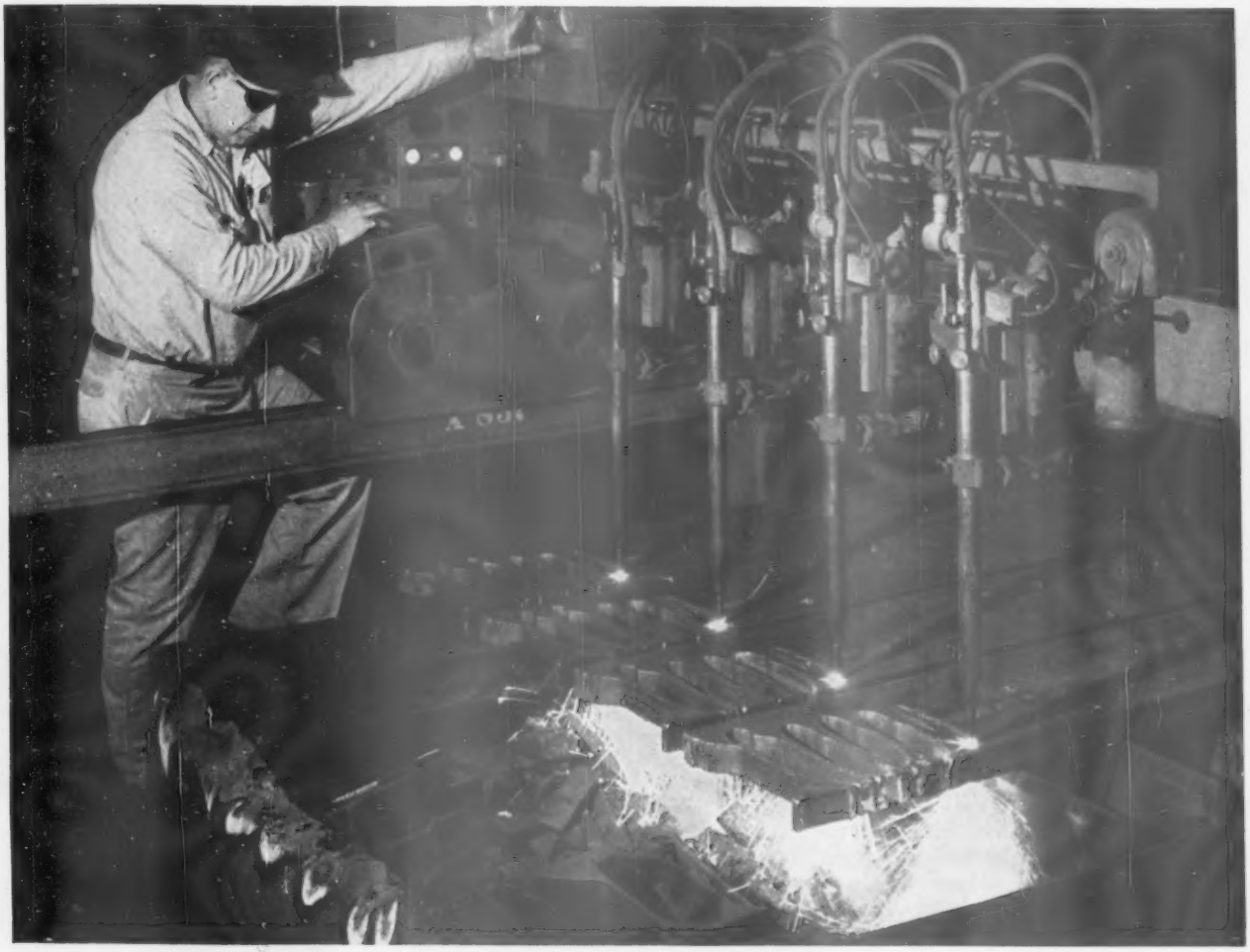
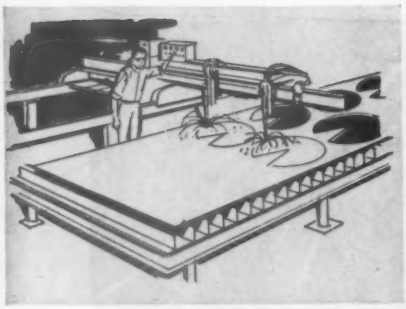


OXYGEN PLANER

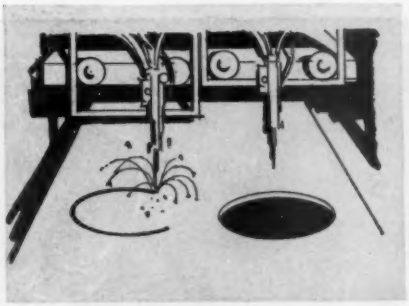
PORTABLE

How Soon Could These Oxygen Themselves in Your Plant?

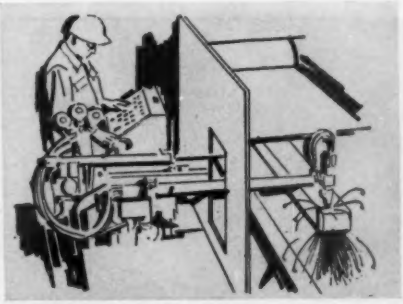




STANDARD



SPECIAL PURPOSE



STEEL MILL

Cutting Machines Pay For One Year? Two Years?

AMF estimates Messer Statosec will pay for itself in eighteen months

Yes, American Machine and Foundry has achieved results far beyond expectations from the Messer oxygen cutting machine shown here. This *Statosec* unit turns out dies (for cigar wrappers) at a rate far faster than they were formerly produced. Cost savings are such that the Messer machine can pay for itself in only 18 months—a factor that can contribute substantially to profits!

Don't Spend Money . . . Make Money! Users find that Messer oxygen cutting equipment makes money for them. For precision and accuracy, Messer machines have no equal. But more important, their use permits automated cutting operations that can greatly reduce costs and add to profits.

Shown above are representative Messer units from the largest range of standard oxygen cutting machines available from any one source. Which one can save *you* the most?

New Brochure! Write or call for a new brochure which describes Messer oxygen cutting machines and their advantages in more detail.

Messer Cutting Machines, Inc.

CHRYSLER BUILDING • 405 LEXINGTON AVENUE • NEW YORK 17, N.Y.

WELDING ENGINEERING · Messer · SINCE 1898

This RACO rod is 40 years old!

The cake is fresh but its candles have been burning brightly for forty years — that's how long Reid-Avery has been manufacturing precision welding rods and wires.

From inception, RACO pioneered in engineering, design and manufacture of welding products because we were not satisfied with existing techniques. RACO developed more rigid specifications for precision welding wire and widened the range of welding electrodes to meet changing requirements . . . constantly aiming at one goal — **welding reliability.**

Four decades of meeting the welding needs of American Industry has provided us with the organization, the discipline and experience to maintain unchallenged quality leadership.

We'll cut a piece of our birthday cake for you at Booth 412 at the Welding Show April 26, 27, 28, in Los Angeles. If you can't attend, let us show you how RACO leadership can benefit you (we're not certain we can send the cake, but we'll try!). Just drop a card to Dept. WE-4.

REID AVERY CO., INC. DUNDALK, BALTIMORE, MD.

APRIL, 1960

Welding Engineer

ESTABLISHED 1916

Be a promoter

We are convinced the Soaring Sixties will be the decade of welding's greatest growth—a decade in which the general public will become more familiar with welding's importance to their well-being.

But the general public must be told, shown and sold welding!

Promotional help from some unexpected quarters has recently made an appearance. Most compact car manufacturers and some conventional car manufacturers are advertising the strength and safety welding provides in their products. Many other manufacturers are proudly proclaiming these product-improving data in their literature and advertising.

Is your organization making similar claims? If the answer is yes, all well and good; if not, what are you doing to promote welding?

April being National Welded Products Month, there is no better time to go to management with the suggestion that they "tell the world" their products are *best* because of welding.

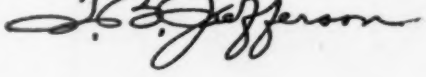
You know and your employers know welding makes a product stronger, lighter in weight, more pleasing in appearance and, in all probability, less costly. Has this been pointed out to your prospective customers?

Potential buyers are those most interested, and those who will benefit the most from this knowledge. Tell them in your advertising, sales literature, sales presentation and every day conversations.

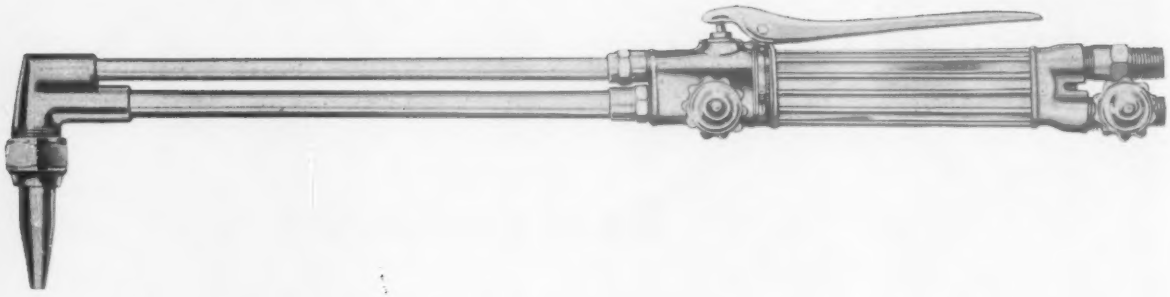
There are many others on the "must-be-told" list: the management of your firm; your engineering department (yes, your company uses welding, but it could probably use much more); your friends (particularly educators, engineers and architects); your neighbors and just about anyone who will listen—even your wife.

The more interest created in welding, the better life will be for everyone, because welding has contributed so much to the betterment of our living conditions.

This is National Welded Products Month. Be a promoter.



WHAT FEATURES DO *you* NEED IN A CUTTING TORCH?



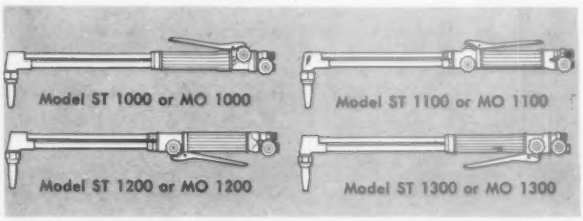
In the Victor line you'll find all the features you want! You have a choice of preheat gases, heads, lever positions, lengths, wide operating range.

FOR ACETYLENE: Model ST and MO series hand-cutting torches.

OTHER FUEL GASES: The new Model STN series hand-cutting torches with improved injector type gas mixers operate on either low (2-6 oz.) or medium pressure natural or propane type gases. This design has been thoroughly field tested and proven for maximum performance and efficiency.

HEADS: You can have either Everdur bronze (ST) or Monel (MO) head, angled at 90°, 75°, 180° . . . or 45° (ST models only).

OXYGEN LEVER POSITIONS: Four, as shown.



LENGTHS: 21", 27", 3' and 4'. (Special lengths on request).

OPERATING RANGES: Standard ST and MO models cut to approximately 8", using acetylene tips to size 5. Heavy duty (HD) models are available for work requiring tips above size 5, for gouging, scarfing, scrap cutting, etc. The new STN series use natural or propane type tips to size 8.

Remember, you can get Victor cutting attachments and machine cutting torches for use with acetylene—also for use with low or medium pressure natural or propane type gases. For the finest choice in cutting equipment, call on your Victor dealer now.

VICTOR EQUIPMENT COMPANY

844 Folsom St., San Francisco 7
3821 Santa Fe Avenue, Los Angeles 58
1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

55

VICTOR for cutting

MFRS. OF WELDING & CUTTING EQUIPMENT; HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; HARDFACING RODS, BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHTLINE AND SHAPE CUTTING MACHINES.

Biltmore Hotel

Los Angeles

AWS annual convention, welding show expected to draw 25,000 persons

CALIFORNIA'S CITY of the Angels will be host this month to an estimated 25,000 welding-associated visitors attending the American Welding Society's 41st Annual National Meeting and Eighth Annual Welding Show.

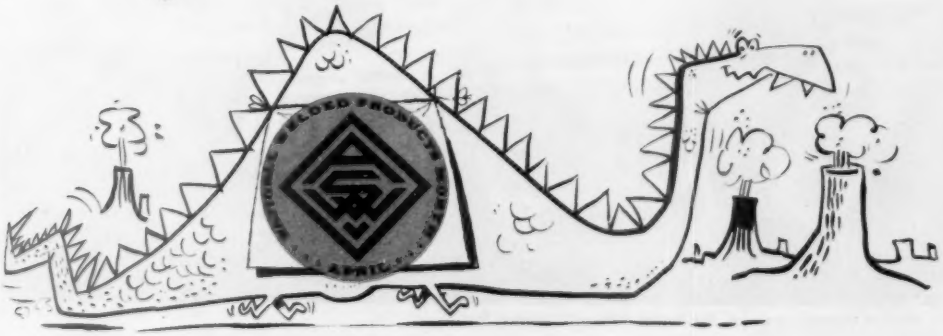
The convention's technical sessions will be held in the Biltmore Hotel, April 25-29, while the show itself, now ranked among the ten largest in the United States, will run from April 26 to 28 in the Great Western Exhibit Center.

Heading the roster of 23 technical sessions during which 69 papers will be presented, is the Adams Lecture, given annually by an outstanding engineer or scientist chosen by the AWS Board of Directors.

This year the honor falls to Robert D. Stout, head of the department of metallurgy, Lehigh University, Bethlehem, Pa. His tentative lecture title is *Higher strength steels in welded structures.*

(For WELDING ENGINEER'S report on one such high-strength steel see page 38, *et seq.*, in this special issue.)

Dr. Stout, who has been known for years as a leader in welding re-



search, coincidentally has been nominated an AWS director-at-large for the 1960-63 term.

Other nominees for national office (who are assured of election, if voting follows its normal course) are: R. D. Thomas, Jr., (Arcos Corp., Philadelphia), president; and John Blankenbuehler (Hobart Bros., Troy, Ohio), A. F. Chouinard (National Cylinder Gas Div., Chicago), Clarence E. Jackson (Linde Co., New York City), vice presidents.

This is the first year that AWS members will vote for three vice-presidents. Under the by-law revisions, voted and approved by the membership last year, the number of vice presidents was increased by one, and seniority was eliminated.

Since membership approval of the revisions came after last year's election, John J. Chyle of A. O. Smith Corp., Milwaukee, who is also a past-president, served the interim term by appointment of the AWS Board of Directors.

Other revisions in the by-laws were: the office of treasurer would be appointed; the number of directors-at-large would be increased from 12 to 13, and the district directors from 10 to 11, the latter serving three-year instead of two-year terms.

For the three-year term beginning in 1960, the following were nominated as directors-at-large: Roy B. McCauley, Ohio State University, Columbus; Ernest F. Nippes, Rensselaer Polytechnic Institute, Troy, N. Y.; John Mikulak, Worthington Corp., Plainfield, N. J.; and Robert D. Stout.

Nominated as district directors for the same three-year term are: George W. Kirkley, Electric Boat Div. (Dist. 1); James M. Shilstone, Shilstone Testing Laboratory (Dist. 4); Lester L. Baugh, Allis-Chalmers Mfg. Co. (Dist. 7); and David P. O'Conner, Los Angeles Dept. of Water and Power (Dist. 10).

NATIONAL WELDED PRODUCTS MONTH
APRIL

An address by AWS president C. I. MacGuffie before the Adams lecture on Monday morning will officially open the technical phase of the convention which continues to Friday morning.

Subjects to be treated during the sessions range from studies of heat effects on steel weldments to discussions of the newest welding processes to enter the welding industry during the past year. Included will be four sessions sponsored by the American Society of Mechanical Engineers. Three papers will be presented at each session.

A two-part educational lecture, delivered by Harry Schwartzbart of Armour Research Foundation, will be presented from 4:30 to 6:00 p.m. on Monday, April 25, and Tuesday, April 26.

Running in conjunction with the meetings will be the Welding Show at the Great Western Exhibit Center. An estimated 150 exhibitors displaying more than $3,000,000 worth of welding equipment are expected.

According to AWS National Secretary Fred Plummer, additional space had to be obtained not only to accommodate the many companies which would otherwise be disappointed, but the many smaller west coast firms as well, which welcome the opportunity to exhibit in a national show.

At the show, visitors will have a chance to see examples of welded construction, including the much-talked-about unitized (welded) automobile chassis, as well as welded products from local industries.

Many manufacturers will unveil new processes, products and equipment for the welding industry—

THE Great Western Exhibit Center, scene of the Eighth Annual Welding Show.

Record Number of Exhibitors at the Show

Air Reduction Sales Co. 303
All State Welding Alloys Co., Inc. 501
Alloy Rods Co. 202
Alphil Spot Welder Corp. 122
Aluminum Co. of America 306
American Brazing Alloys Corp. 208
American Platinum & Silver Div. 503
American Pullmax Co., Inc. 805
Arcair Co. 800
Arcos Corp. ..... 300 & 700
Aronson Machine Co. 524
Balteau Electric Corp. 517
Battelle Memorial Institute 601
Bay State Abrasive Products Co. 802
Bernard Welding Equipment Co. 518
Birdsell Mfg. Co. 615
Blackhawk Industrial Div. 302
Bren Weld Corp. 520
E. D. Bullard Co. 613
Cam-Lok Div. 403
Capital Welding & Mfg. Co., Inc. 510
Chicago Tool & Engineering Co. 622
Contour Marker Corp. 519
Cosa Corp. 111
Coyne Cylinder Co. 505
Dockson Corp. 104
Elmet Div. 514
Emerson Electric Mfg. Co., Inc. 620
Eutectic Welding Alloys Corp. 405
Exomet, Inc. 611
R. C. Fessler & Co. 514
Fibre-Metal Products Co. 702
Flood Safety Products Co. 514
General Dynamics Corp. 422
Glendale Optical Co., Inc. 433
Gregory Industries, Inc. 310
Handy & Harman 322
Harnischfeger Corp. 317
Harper Trucks, Inc. 512A
Harris Calorific Co. 404
Hobart Bros. Co. 318
Industrial News 515
International Nickel Co., Inc. 420
Jackson Products Div. 321
K-G Equipment Co., Inc. 623
KSM Products, Inc. 406
Kaiser Aluminum & Chemical Corp. 608
Kedman Co. 612
Lenco, Inc. 120
Lewis Welding & Engineering Corp. 308
Lincoln Electric Co. 219
Linde Co. 211
Lummis Mfg. Co. 514
McKay Co. 103
Magnaflux Corp. 621
Markal Co. 608
Marquette Mfg. Co., Inc. 121
Metal & Thermit Corp. 604
Metallizing Co. of America 105
Mid-States Welder Mfg. Co. 413
Miller Electric Mfg. Co., Inc. 311
Milwaukee Electric Tool Corp. 523
Mir-O-Col Alloy Co., Inc. 106
NRC Equipment Corp. 602
National Cylinder Gas Div. ..... 417 & 418
National Torch Tip Co. 410
National Welding Equipment Co. 207
Norris-Thermador Corp. 108
North American Aviation, Inc. 414
North American Philips Co. 421
Ohio Nut & Bolt Co. 110
Omark Industries 607
Page Steel & Wire Div. 514
Pandjiris Weldment Co. 118
Cecil C. Peck Co. 618
Philips Electronics, Inc. 301
Phillips Drill Co. 315
Picker X-Ray Corp. 200
Ragle Industries, Inc. 616
Ransome Co. ..... 400 & 424
Reid Avery Co. 412
Rexarc, Inc. 113
Robotron Corp. 504
Robvon Backing Ring Co. 801
Sellstrom Mfg. Co. 100
Shober, Inc. 614
Simonds Abrasive Co. 516
A. O. Smith Corp. 209
Smith Welding Equipment Corp. 102
Sperry Products Co. 112
Standard Steel Corp. 119
Steffan Mfg. Corp. 803
C. H. Stevens & Co. 403A
Steody Co. 312
Sylvania Electric Products, Inc. 617
Tec Torch Co., Inc. 619
Tempil Corp. 407
Thermacote Co. 511A
John Tillman & Co. 609
Tweco Products, Inc. 512
Uniflex Cable Div. 107
Unique Equipment Inc. 319
United Wire & Supply Corp. 409
Vacuum Tube Products Div. 610
Victor Equipment Co. ..... 313 & 314
Wall Colmonoy Corp. 201
Weldex Div. 109
Welding Alloys Mfg. Co. 120A
WELDING ENGINEER 804
Weldmatic Div. 521
Martin Wells, Inc. 419
Welsh Mfg. Co. 408
Weltronic Co. 114
Westinghouse Electric Corp. 115

and electrodes seem to be the favorite new product this year.

Two new cobalt-chromium tungsten alloy electrodes will be introduced by Alloy Rods Co., York, Pa. The electrodes, called Wear-Arc CoCr-A and Wear-Arc CoCr-C, are extruded and have a cast core ground to a precision diameter.

According to the company, both operate excellently on a-c or d-c and can be used for out-of-position work. Bare rods will also be made.

A second company, Eutectic Welding Alloys Corp., Flushing, N. Y., plans to demonstrate an electrode for welding cast iron. The difference in the electrode is that the weld deposit can be quenched, contrary to conventional practice where each pass must cool slowly before the next can be deposited.

As a result, the firm claims cast iron welding can now be accomplished in 1/4 to 1/10 the time required by conventional methods—and without cracking.

A. O. Smith Corp., Milwaukee, will be a third manufacturer to display a new electrode, the SW 612. Because of a different formulation of the coating, Smith states the electrode has much more efficiency at high currents and can cut spatter loss up to 60%.

Further claims made for the new electrode are: reduced (by at least 50%) slag removal and cleaning time; increased crack resistance, reduced number of rejects where appearance is important; and easier manipulation by the weldor.

The Milwaukee firm also plans to introduce its Premier line of a-c welders with a lateral rather than vertical coil movement. The new design saves as much as 1-ft off cabinet height—but without increasing required floor area.

A third new development to be unveiled by A. O. Smith at the show is its portable d-c welder. This engine-driven welder has a 2,000-watt boost in a-c auxiliary power, making it more versatile for field work. Electric starting is now an optional feature of the unit.

Still another company planning to reveal a "first" is Robotron Corp., Detroit. A new welding control and power system, called "spike power" welding, combines the advantages of normal capacitor discharge and percussion welding without the inherent disadvantages, says the firm.

The system depends on a new coaxial ignitron tube contactor which is capable of handling very high peak currents for short time periods without misfiring or breakdown. (See p. 84.)

An electron beam welder and a pantograph-designed cutting machine, manufactured by Air Reduction Sales Co., New York, are two more new products which will be demonstrated at the annual Welding Show.

See us at booth 804

How to weld T-1 steel

Another in a series of WELDING ENGINEER articles on how to weld the high-strength and exotic metals

As is the case when welding any metal, to properly join T-1 steel*, a basic knowledge of the metal, of electrodes and of proper welding procedures is necessary.

The basic methods of working T-1 steel and structural carbon steel are similar — but the former requires more care to get the same results.

T-1 steel's differences stem from the fact that it is a heat-treated alloy, (developed by United States Steel Corp.) containing small amounts of several alloying elements added so that the steel will respond better to heat-treatment.

After being rolled to shape (usually into plates) it is quenched and tempered in the following manner to develop very high strength and toughness.

It is first heated to 1,650 F, rapidly quenched in water to room temperature, then held at 1,150 F for tempering. The result is a steel with 100,000 psi yield strength and a hardness of approximately 274 BHN.

Except for certain precautions, T-1 is fairly simple to weld. Strong, reliable joints can be obtained when three precautions are followed: use proper electrodes; correct welding heat; and recommended procedures.

*Registered trademark of United States Steel Corp.

Of the three, the most important is using the right electrode, that is, low-hydrogen electrodes for manual metal arc welding, or a low-hydrogen method such as Tig, Mig or submerged-arc welding.

As in any welding of alloy steels, hydrogen is the number one enemy of good welds in T-1.

In the extreme welding heat, any hydrogen in the electrode coating, or hydrogen picked up as moisture, is released and absorbed by the molten metal.

But as the weld metal cools, its capacity to dissolve and hold hydrogen is greatly reduced. The gas is forced out into small cracks and openings, building great pressure and causing underbead cracking.

What happens to a weld having underbead cracking? It is not as strong, naturally, because the metal is not joined in some places. In a butt-weld, if the two welded plates were put under a pulling force, the weld would be much weaker and more apt to fail.

And since nearly all butt welds are subject to such forces, underbead cracking cannot be risked.

Choosing the correct electrode is simply a matter of knowing electrode classifications, which are always marked on the containers.

For low-hydrogen coatings, the last two numbers

of a classification should be either 15, 16 or 18 (*e.g.*, E8015, E9016, E11018) and no others.

The first two or three numbers in the classification refer to deposited metal strength. For run of the shop welding, where the electrode is not specified but where the finished weld must be as strong as the T-1, choose electrodes of the E110-15, -16 or -18 types.

Higher strength may also be used if 110's are not available. However, it is advisable never to go lower than 100 since this is slightly below T-1's rated strength.

Electrodes or wire-flux combinations containing vanadium should never be used to weld T-1 parts which will be stress relieved. Vanadium-containing weld metal is likely to be made brittle by stress relieving.

Since stress relieving is seldom necessary, this problem should not occur too often. There are exceptions: where stress relief is required by codes; where stress corrosion may be involved; or where dimensional stability of machined parts is necessary.

(When welding T-1 to a lower-strength steel, electrode strength should be the same as that recommended for the lower-strength steel, but still a low-hydrogen type.)

Correct handling of electrodes is also very important. Low-hydrogen coated electrodes when exposed to air will pick up moisture which generates underbead cracking.

So in addition to choosing the correct electrode, steps must be taken to keep them dry once the container is opened. One good method is to never open more than a two hour supply. This will prevent electrodes from standing in the air over a long enough period to pick up too much moisture.

Another method is to keep the electrodes hot at temperatures of 250-300 F in an oven. They can also be dried by baking.

Check with the electrode manufacturer for correct temperatures and times to use in electrode drying. One hour at 800 F is average.

Welding arc temperatures (up to 11,000 F) are some of the highest generated. And although this heat is concentrated in a small area, it is desirable to preheat most alloy steels.

Most welded joints are improved by relatively high amperages in welding; that is, high temperatures and high welding heats result in good welds on most structural steel because the joint's cooling time is lengthened.

However, the best welds in T-1 depend on never exceeding a certain maximum heat so the weld area will cool rapidly. In this way, the weld area will harden, but not become brittle.

One practical way of controlling cooling time is to control heat input. The amount of preheat and welding heat put into a weld must be kept within boundaries during actual welding. In general, do not preheat T-1 steel except in certain cases.

Preheat is not recommended, particularly with thin plate, because it only adds to the heat input when

FIG. 1 — Calculator is set for 25 volts, 200 amp, 5 ipm. The result (arrow) shows this test set-up would produce 60 heat units. Reverse side has table which will indicate if heat is correct for that T-1 thickness.

welding is done. Since the best welds in T-1 result when the metal cools rapidly, preheat defeats this purpose.

There are, of course, exceptions, *e.g.*, moderate (approximately 100 F) preheat for moisture drying purposes to eliminate any possible underbead cracking caused by hydrogen.

Preheat might be used when the item being welded is fastened so there is no shrinkage freedom after welding, or when extremely thick pieces are being welded. If preheat is used, heat input maximums should be calculated and used.

Heat input depends principally on amps and arc travel speed. The higher the amperage, the more heat input; the slower the arc travels, the more heat input. So controlling heat really requires keeping amps below certain ceilings and arc travel above certain speeds.

Two other factors must be considered: steel thickness and temperature. Thicker plates absorb more heat than thinner plates. Hence, on thicker plates higher amps and slower arc speeds are permitted.

If the steel plate is already hot from preheat or previous electrode passes, amperage must be decreased or arc speed increased. The circular Heat Input Calculator shown in figure 1 (available from U. S. Steel Corp.) quickly gives the safe heat input for any T-1 plate.

The front of the calculator indicates how much heat will be put into a joint if amperage, volts and speed are known. On the opposite side is a table of heat inputs recommended for T-1 plates of different thicknesses at different temperatures.

Before actually using this circular slide rule, amperage, volts and speed should be chosen for a trial setup. If the calculated heat is more than the suggested heat input, adjustments can be made by lowering amperage or increasing arc speed until the heat input value is no higher than the table value.

Since heat input must be controlled, the stringer method of laying a bead is preferred over a full weave.

Weaving adds heat because of its slower speed along the joint. The proper method is to fill the groove with a succession of stringer beads.

Before a bead can be laid over an earlier bead, flux, scale and oxidation must be removed from the earlier bead by powered or manual brush and hammer.

When back-gouging, arc-air followed by cleanup grinding is preferred. Do not use an oxyacetylene torch because of possible overheating.

Since high-strength electrodes are often required and joints are usually expected to withstand greater forces, a good fillet welding technique is important.

Fillet welds must be smooth, correctly contoured and faired-in to the legs. Each weld layer should be made so that there is good root penetration, yet no undercutting. Figure 2 (a) shows the ideal fillet, while (b) shows what to avoid.

Fillet welds are sometimes troublesome when thick (1½-in. or more) pieces are to be joined, and also when the finished weld is to be stress relieved. In these cases, toe cracking (caused by weld metal shrinkage as it cools) is likely.

There are several methods of eliminating toe cracking. Since most Tee and El joints do not require the strength needed in butt joints, lower strength electrodes (*e.g.*, low-hydrogen types of the E90, 80 and 70 classes) can be used.

Air hammer peening can also help prevent cracking, especially if the weld is to be stress relieved. When peening is done, even joints using high-strength electrodes should be free from toe cracking.

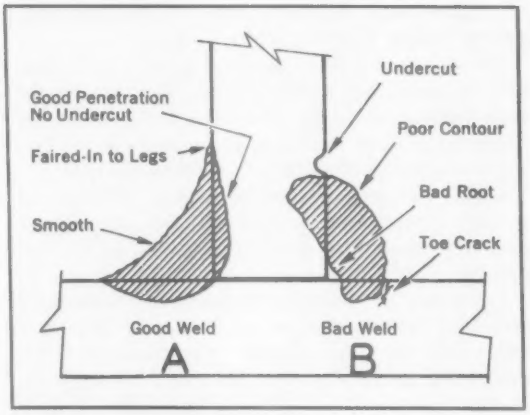


FIG. 2 — An ideal fillet weld is shown as (a) while (b) shows what to avoid when making the same type weld.

Good peening pushes the weld metal around so that shrinkage forces are greatly reduced when the metal cools. At times each fillet pass may require peening; at others, only the toe passes. Fillets should be smoothly ground to fair the fillet after peening.

Three other methods of preventing toe cracking are shown in figure 3. C shows copper or other soft wire used as a pedestal; D shows a machine-grooved upright; and E is a "butter weld" in the area of the toe cracks.

The first two allow the upright leg to shrink down into the bottom plate during cooling. The third is a method of strengthening the T-1 at the point where toe cracking might begin.

In this last method, a bead is laid, then ground off prior to actual welding. This "butter weld" must be located so that the toe passes will be laid over them during actual fillet welding.

Thus, it can be seen that the difference between T-1 and structural carbon steel is like the difference between white pine and maple. The basic methods of working each are similar, but the stronger material requires a little more attention.

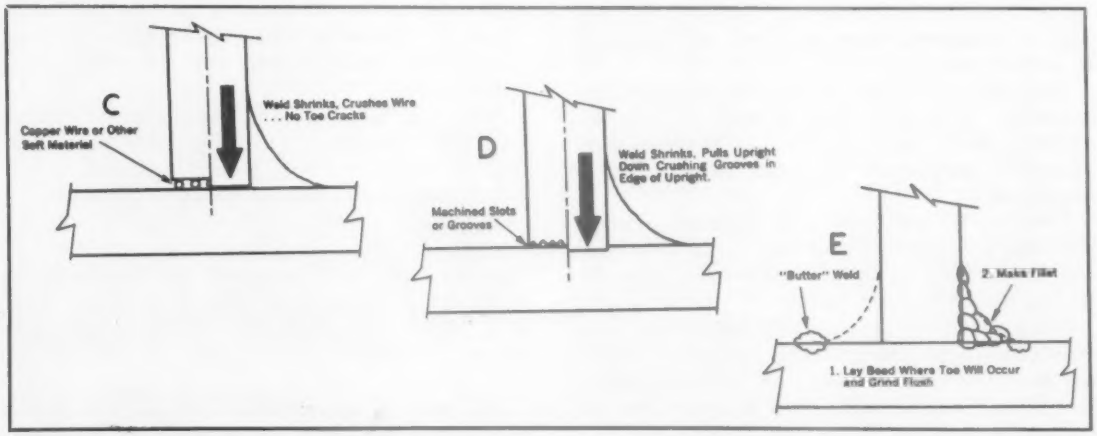

C
Copper Wire or Other Soft Material
Weld Shrinks, Crushes Wire . . . No Toe Cracks
D
Machined Slots or Grooves
Weld Shrinks, Pulls Upright Down Crushing Grooves in Edge of Upright.
E
"Butter" Weld
2. Make Fillet
1. Lay Bead Where Toe Will Occur and Grind Flush

FIG. 3 — Three methods of preventing toe cracks are: (c) copper or other soft wire used as a pedestal; (d) a machine-grooved upright; and (e) a butter weld in the area of the toe cracks. The first two allow the upright leg to shrink down into the plate during cooling. The third strengthens the T-1 plate at the point where toe cracking might begin.

Mechanical properties of T-1

Thickness	3/16 to 2½ in. incl.	Over 2½ to 4 in.	Over 4 to 6 in.
Yield strength, ext. under load (min)	100,000 psi	90,000 psi	90,000 psi
Tensile strength	115,000/135,000 psi	105,000/135,000 psi	105,000/135,000 psi
Elongation in 2 in., % (min)	18	17	16
Reduction of area, % (min)	50*	50	45
Longitudinal or transverse Charpy keyhole impact values	15 ft lb at –50 F	—	—
Charpy V-notch impact values			
Longitudinal	30 ft lb at –10 F	—	—
Transverse	20 ft lb at –10 F	—	—

**A standard 0.505 in. tensile specimen is used if thickness exceeds ¾ in. For sizes ¾ in. and under, an ASTM plate tensile specimen is used which necessitates lowering of the reduction of area specification to 40% minimum.*

Minimum yield strength and tensile strength requirements of plates from 3/16 to 2½ in. inclusive may be reduced to 90,000 psi and 105,000 psi respectively if so desired.

Plates over 6-in. thick may be obtained on special application. Impact tests apply only to Firebox and higher qualities. Test results can be reported upon negotiation.

Minimum impact values shown above apply only to plates ½ to 2½ in. thick inclusive. Modified values may be negotiated for lighter plates.

Impact test results on Firebox quality plates over 2½ to 4 in. inclusive can be reported for information only if required.

Transverse mechanical properties may be specified in thicknesses up to 4 in. inclusive. Mechanical properties to closer limits than those shown may also be negotiated.

Other characteristics

Heat treatment

T-1 steel is water quenched from 1,650/1,750 F and tempered at 1,100/1,275 F.

Fatigue strength

Rotating beam endurance limit, polished specimen — 67,000 psi
Pulsating fatigue endurance limit, unwelded (surface as-rolled) — 50,000 psi

Corrosion resistance

Four times that of structural carbon steel

Modulus of elasticity

In tension, approximately 30,000,000 psi
In compression, approximately 30,000,000 psi

High temperature strength

Creep rupture strength at 900 F — three times that of carbon steel and equal to conventional ½% Cr — ½% Mo steel.

Weldability

Joint efficiency with E11015, E12015 or equivalents — 100%
Joint efficiency with automatic welding — 100%
Kinzel transition temperature for welded ½ and 1-in plates .....minus 40/90 F
Maximum hardness, heat affected zone.....410 DPH
Minimum hardness, heat affected zone .....260 DPH

Shear strength

Yield — approximately 58% of tensile yield
Ultimate — approximately 75% of tensile ultimate

Coefficient of expansion

7.74 by 10^{-6} in. per inch per F in the range of 70 to 1,300 F.

Cold forming

Thickness	Suggested min inside radius
Up to 1 in. incl	2T
Over 1 to 2 incl.	3T

Cold bend properties

Cold bend	0.1875 to 0.249 in.	¼ to 1 in.	Over 1 to 2 in.	Over 2 to 4 in.
Transverse	90 D=4T	180 D=2T	180D= 3T	180 D=4T
Longitudinal	180 D=2T	180 D=2T	180D= 3T	180 D=4T

Giant dipper takes 70-cu-yd bites easily

VIEW shows completed boom in raised position with dipper and dipper handle being installed in giant shovel. Below, at left, is a closer view of the 70-cu-yd T-1 steel dipper.

IN THE PAST 10 years, the art of big shovel making has been able to increase dipper size to a point where one shovel can now take a 70 cu-yd bite from the earth.

Ramming through shale and rock to uncover some two million tons of coal per year, this mammoth shovel, called Big Paul, can dig and dump 105 tons in 50 seconds.

One of three built by Marion Power Shovel Co., Marion, Ohio, the "king of spades" sets the pace at the Peabody Coal Co.'s River King mine near Freeburg, Ill.

The dipper, boom and dipper handle on Big Paul are all of welded T-1 steel. This combination makes them lightweight, yet tough enough to withstand the continuous impact abrasion and shock loading, even at temperatures far below zero.

To weld these shovel components, the company used E9018 electrodes for stress-relieved components and E11018-G electrodes for

those remaining as-welded. Diameters ranged from 5/32 to 1/4 in. (The E11018 was used primarily for field erection and units too large to stress relieve.)

The 150 power sources used for the manual metal-arc welding included a-c transformers (at 500 amp), rectifiers (at 600 amp) and d-c motor generators (400-600 amp).

Normal square and beveled flame-cut edges were used throughout shovel fabrication with a minimum of edge smooth-up and deburring.

Preheating up to 200° F with natural gas equipment was used in sections of the dipper on plate thicknesses of 1½ in. due to joint restraint. And a 400° F preheat was maintained throughout the welding cycle on the 7-in.-thick dipper lip section.

Approximately 5,000 hours of shop welding and 1,500 hours of field welding were required to fabricate this welded T-1 steel giant.

Big Paul's dipper measures 16-ft. wide, 17-ft. high and 22-ft. deep. The dipper itself was made of 1 to 7-in. T-1 steel plate, while plate for the dipper door was 1 to 3 in. The dipper bail used T-1 plate ranging from 1 to 1¼ in.

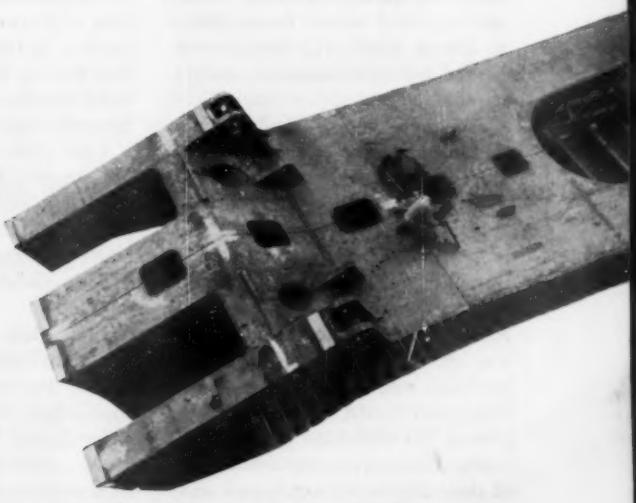
The 102-ft-long (including dipper), 5½-ft-wide dipper handle used ¾ to 1½-in. plate. The 175-ft-long boom (with each leg measuring 10-ft high and 6-ft wide) was fabricated from ½ to 1¼-in. plate. Racking sections of 5-in. plate were heat treated to a high Brinell hardness before welding.

DIPPER handle, fabricated from T-1 steel, will be welded in the field to the top of the dipper.

According to a company spokesman, the firm feels it would be impossible to manufacture a machine of this size and capacity without welding because of weight-strength ratios.

Welding and T-1 steel have also enabled bucket capacities to be increased on other company equipment. For example, a 20-yd bucket was replaced with a 24-yd bucket. Other dippers were boosted from 26 yd to 32, and from 36 to 45 yd — increases of 25%.

HANDLE and dipper are hauled to final field erection by truck.



EXTREME point of T-1 steel boom is shown in final shop assembly.

by J. S. Kobler
U. S. Naval Gun Factory

New electrode developed by Navy for welding dynamically-loaded T-1

A NEW ELECTRODE, capable of producing notch-ductile stress-relieved welds in dynamically-loaded T-1 steel, has been developed by the U. S. Naval Gun Factory.

The electrode is the result of extensive tests to find a weld metal suitable for use in fabricating a welded T-1 shipboard missile launching system.

Material selection for the missile system was restricted to light-gage, high yield-strength T-1 steel for two reasons. (1) It would be subjected to exceedingly high stress and impact at service temperatures as low as 10 F. (2) Design was limited by rigid maximum weight requirements.

However, before actual fabrication could begin, some objectionable characteristics were detected and had to be eliminated.

A notch-sensitive fusion-zone was observed in the stress-relieved T-1 steel weld made with available electrodes. This notch sensitivity was attributed to chemical incompatibility resulting from liquid dilution and partial solid state diffusion of the weld-base complex.

Further complicating fabrication of the Mk 9 launching system was the prohibition of preheat prior to welding. A preheat treatment would prevent possible microstructural transformation from a notch-tough low-carbon martensite to a notch-sensitive austenite-enriched microstructure.

Still another consideration was that for purposes of fabrication, where dimensional stability was of major importance, it was essential to provide for stress relief annealing during assembly.

Although T-1 steel does not decrease in strength and notch toughness as a result of stress relief, according to the manufacturer, little was known about the reaction of weld metal subjected to such a thermal cycle.

Until 1956, 100% weld-joint efficiency could not be obtained by any weld metal deposited with a commercially available electrode under conditions specifying stress-relief annealing without an embrittling effect.

Since then, electrode development has progressed to a point where stress-relieved weld metal approaches the mechanical properties desired. Unfortunately, additional weldability complications were evident, and it became apparent that an electrode had to be designed to meet the requirements of the Mk 9 system.

It was mandatory that no significant decrease in notch toughness occur in the weld metal, base metal or the weld affected zones. That is, uniformity in static and dynamic-strength levels was sought as a requisite for fabrication.

Arc welding electrodes selected for use in this weldability study are identified and described in table 1. Those electrodes designated A, B and C were the only filler materials available for evaluation when the study began.

Electrodes D and E were chosen for final testing only after a preliminary review of test results obtained with the initial group provided enough data to warrant a continuation of the study.

All electrodes were specifically designed for welding T-1 steel to meet both the as-welded and stress-relieved tensile and impact property requirements.

However, no requirements regarding chemical composition of non-dilution weld metal were established as prerequisites. Electrode chemistry was optional as long as the desired static and dynamic mechanical properties were

Description and identification of test electrodes

Electrode identification	Size inches	Classification	Coating type	Status at time of test
A	5/32	11015	Low hydrogen	Experimental
B	5/32	12016	Low hydrogen	Commercially available
C	5/32	11018	Low hydrogen iron powder	Experimental
D	5/32	11015	Low hydrogen	Experimental
E	5/32	11015	Low hydrogen	Experimental

TABLE 1 — Arc welding electrodes selected for Navy's weldability study on notch-ductile stress-relieved weld metal for T-1 steel.

comparable to those of the T-1 steel.

Extensive Charpy V-notch tests were run on numerous test specimens varying in size, temperature, etc. An analysis of theoretical chemistry of dilution or subweld metal zones for electrodes A and B provided the basis for some preliminary modifications in electrode design to eliminate detrimental dilution-diffusion effects.

These recommendations were:

(1) Provide for a slight increase in carbon to compensate for the reduction in other alloying elements. This would tend to retain the required tensile properties of electrode weld metal.

(2) Consider an increase in manganese as a compensating alloy addition to meet tensile requirements and provide notch toughness under conditions requiring a stress relief anneal.

(3) Restrict nickel to a reasonable maximum level not exceeding 18% of typical nickel content of the T-1 steel. No reduction in weld metal strength or notch ductility below those observed for base metal would be anticipated as a result of this limitation.

(4) Reduce chromium content to a minimum. This could be done without affecting tensile properties because of the proposed increase in carbon and manganese. Also, a reduction in chromium content could avert formation of excessively brittle intermetallic compounds, complex chromium borides and single phase metal carbide constituents.

(5) Maintain molybdenum at a level not exceeding 60% of the typical quantity contained in T-1. This would tend to decrease transition temperatures and provide for adequate weld-metal notch ductility.

In keeping with these recommendations, an electrode was developed to produce a nondilution weld deposit conforming to the following approximate composition, which was also suggested to the cooperating electrode manufacturers:

Carbon	0.10%
Manganese	1.60%
Silicon	0.50%
Nickel	1.20%
Chromium	0.00%
Molybdenum	0.20%

Electrodes D and E represented filler materials submitted after recommendations had been issued. No major changes were effected in electrode D other than coating ingredient and processing modifications. These slight changes facilitated a general rise in levels of energy absorption for both weld metal and fusion zone.

Modifications in the form of electrode alloy design, instituted by the manufacturer of electrode E, were substantial. The weld deposit analysis was similar in chemistry to the suggested nominal composition. Stress-relieved weld metal was equivalent to T-1 steel base metal in tensile properties to the extent that 100% joint efficiency could be expected.

Most important, however, was establishment of a uniform level of energy absorption across the weld joint.

The information obtained as a result of the Charpy V-notch tests on the five electrodes was utilized as a parameter in the preparation of a welding electrode specification for procurement purposes.

The specification applies to electrodes suitable for welding T-1 steel structures subjected to dynamic loading where stress relief annealing is mandatory.

The major requirement, other than static and dynamic properties of weld metal, is the introduction of a minimum fusion-zone efficiency based on the characteristics of weld metal and base metal.

Type, classes and sizes of the low-hydrogen electrodes can be seen in figure 2.

Electrode classification

Type*	Class	Welding position	Size, inches
NORD 110-15	1	All positions	3/32, 1/8, 5/32, 3/16
NORD 110-16 NORD 110-18	2	Flat and horizontal	7/32, 1/4

**The number "15" denotes low-hydrogen electrode for use with d-c reverse polarity only. Numbers "16" and "18" denote low-hydrogen electrode for use with either a-c or d-c reverse polarity.*

TABLE 2 — Type, classes and sizes of low-hydrogen electrodes as listed in the proposed military specification resulting from the weldability study.

LAND clearing blade on tractor has a T-1 steel edge and a T-1 stinger (lower right end of blade) to split trees which can then be cut down easily. Below, blade and stinger are seen in action. Stump can then be cut off at any level desired.

Submerged-arc welded land clearing blade uses T-1 steel

by **Raymond Cunningham**
Rome Plow Co.
Cedartown, Ga.

LAND CLEARANCE is providing an important and fast growing market for crawler tractors not only in North America, but in many foreign countries, including some in the tropics.

Although the tractors supply the power, the big push needed requires sturdy clearing blades of proper design, strength and wear resistance.

One such blade, the K/G manufactured and patented by Rome Plow Co., Cedartown, Ga., includes a tough, sturdy T-1 cutting edge and a T-1 "stinger" set at right angles to the blade.

(The stinger has a sharp edge to split and weaken trees so they can be sheared off cleanly. The same stinger splits the stump, making it easier to shear off at ground or lower level.)

The cutting edge and stinger are first submerged-arc welded to each other and then joined to high carbon (1040) steel plates and wrought steel reinforcements.

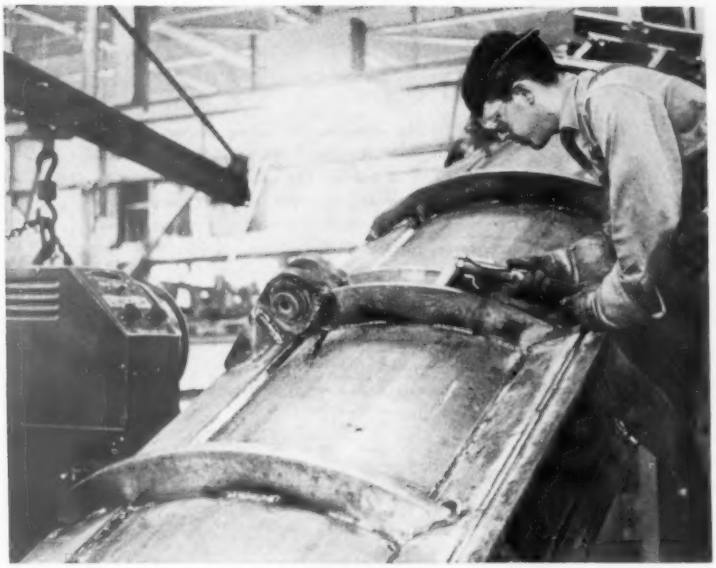
The main T-1 cutting edge plate has a 1 by 12 in. section except where its front edge is given a double bevel for cutting purposes. At its rear edge, the plate is welded over its full length to a 1¼ by 10 in. 1040 carbon steel plate.

These two plates are then reinforced and stiffened by other components, including a curved 5/8-in. 1040 plate. A fillet weld joins this reinforcing plate's lower edge to the T-1 plate, and its upper edge to the upper carbon steel plate.

These welds and about three-quarters of all the welds in the complete blade structure are made with semiautomatic submerged-arc welding equipment manufactured by The Lincoln Electric Co. By adjusting to correct speed, most welds produced can be made in a single pass.

Initially, an alloy flux for all welds involving T-1 was thought necessary. However, this flux is used only for joining T-1 to itself (where the blade and stinger meet) since good welds with ample strength can be made with a regularly used flux.

Nearly all welding of blade components is done in three trunnion-mounted fixtures, two of which are duplicates and adjustable for different length blades. Trunnion supports for the larger fixtures are in vertical column tracks and are supported by hoist cables so fixtures can be easily raised and



WELDOR joins reinforcing ribs to back of blade plate using semiautomatic submerged-arc gun. Wire is 3/32-in.-diameter mild steel.

lowered to bring the assemblies to a convenient working height.

Manual metal arc welding using a 1/4-in.-diameter E6024 electrode is done at points not convenient for semiautomatic submerged-arc.

For convenience, the submerged-arc control unit is hung from a swinging boom extending from a pivot at the column where the two final assembly fixtures come together. The boom also extends to the subassembly fixture.

The control unit includes a reel of 3/32-in.-diameter mild steel wire and a closed flux hopper, which is kept under 30 psi air pressure from a shop line. Current up to 800 amp is produced by a motor generator.

An estimated 30 lb of weld metal per hour is deposited. Welding speed is varied to suit the size of the bead required, but all welds are single pass.

Blade construction starts in the subassembly and includes the long, heavy weld joining the T-1 blade to the 1040 steel plate. These two components are set at an included angle of about 135 deg.

A deep groove with a 45 deg angle is left between the square edges of the two plates. When this weld is completed, the curved plate is tack welded in place, after which fillet welds are made along its two edges. In the K/G 8 blade these welds are about 155 in. each.

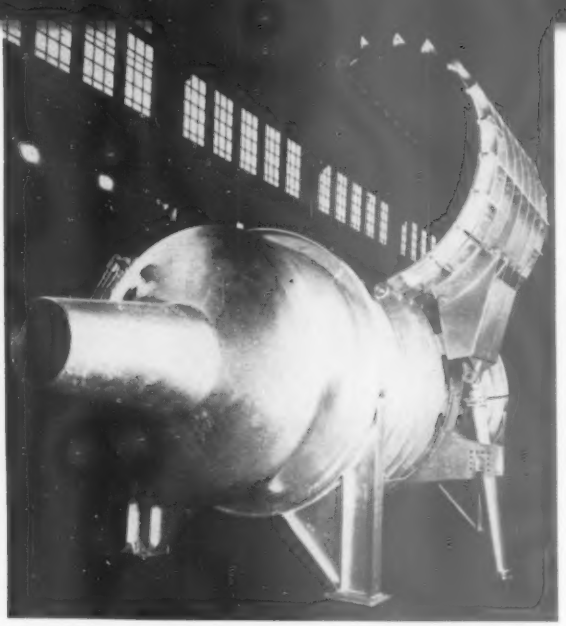
When completed, the subassembly is shifted to one of the final assembly fixtures where the 1/2-in. curved mold board is tacked in place and joined to the 1 1/4-in. plate by a fillet weld. Stinger, stiffering ribs, attaching parts and pusher tube extensions are then added.

(The pusher tube is a safety factor designed to keep trees from falling toward the tractor.)

Blade edge and stinger undergo wear in service and have to be reground from time to time in the field. When these are worn out, they are flame-cut and replaced by metal arc welding new parts to the blade.

PUSH arms to activate the cutting blade are submerged-arc welded, as are most of the parts.

CUTTING edge assembly is also submerged-arc welded. Note the suspended control unit at left.



GIANT test chamber for testing nuclear aircraft engines was fabricated from T-1 by Hodge Boiler Works, East Boston. The chamber, 40-ft long, 12½-ft diameter, operates at high temperatures and pressures. Shell thickness was reduced to 1¼ in. compared to 2 in. had carbon steel been used. As a result, vessel weight (160 tons) was about 90 tons less. All welds were dye penetrant checked after the first and last passes. Whenever possible, welds were radiographed. The weight reduction made possible appreciable cost savings and greatly simplified handling.

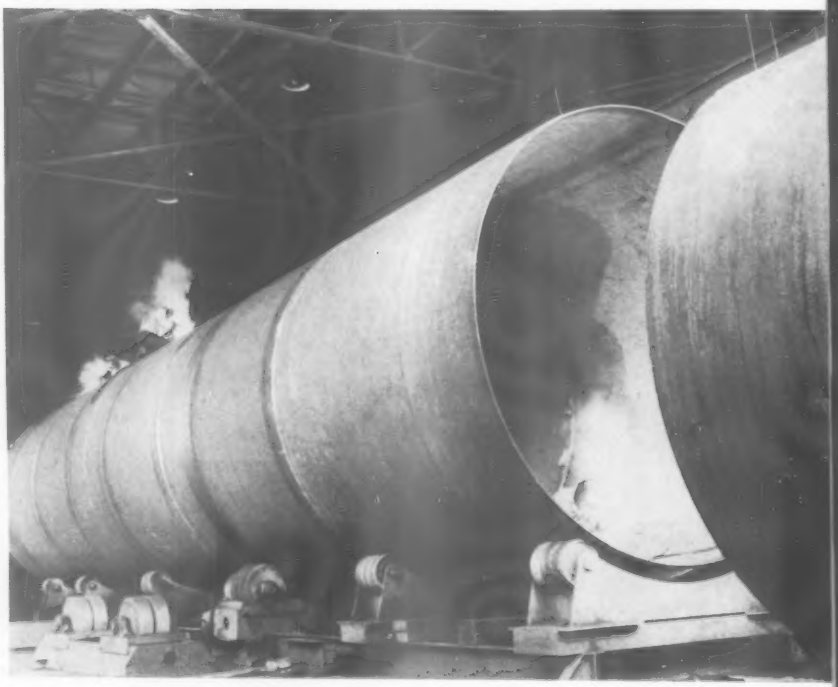
T-1 steel proves its harmony with welding

PRESSURE VESSELS, bridges, shipbuilding, construction machinery, general industrial equipment—T-1 steel has proved itself in all of these applications during its first seven years.

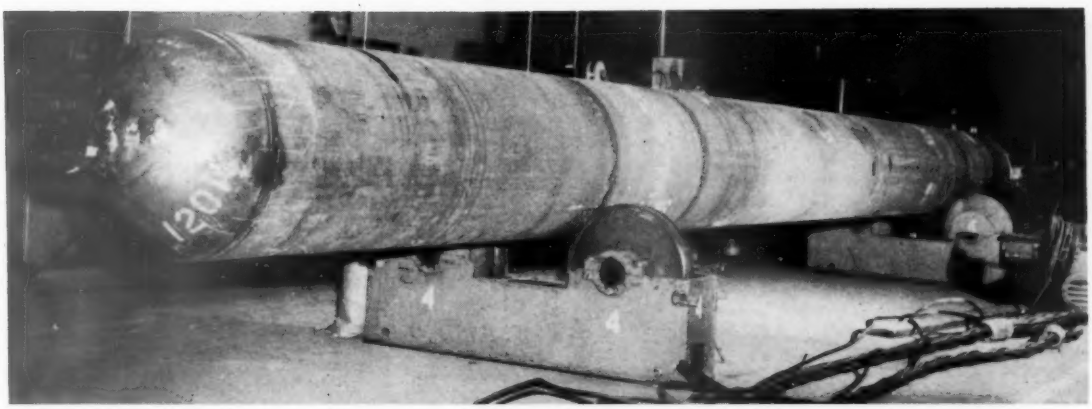
At the same time it has proved itself equally adaptable to welding. T-1 can be fabricated, modified or repaired, not only in the shop but in the field as well, without unusual problems.

On these pages are shown several T-1 applications from the records of Lukens Steel Co., Coatesville, Pa., which both manufactures and fabricates T-1 plate.

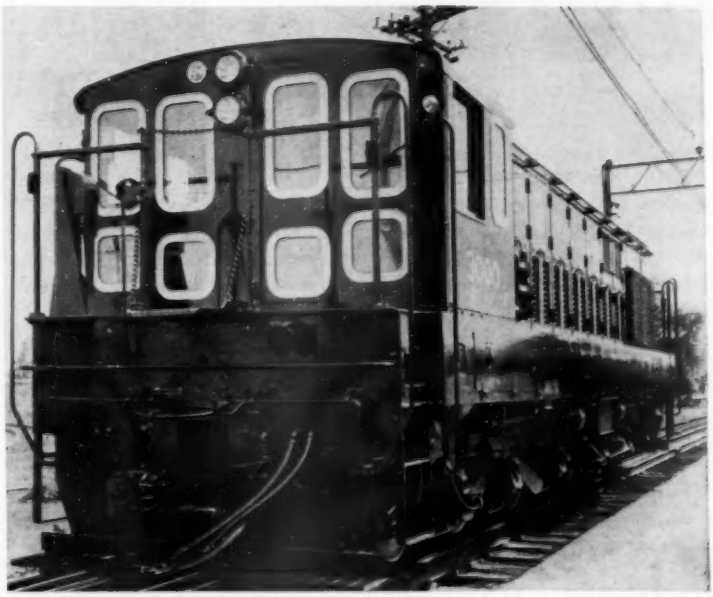
These applications definitely document T-1 steel's harmony with welding.



AIR accumulator vessel with 50,000 gal capacity is welded in sections at Allied Steel Products, Newport, Del. Using T-1 steel made it possible to utilize a 1¼-in. shell thickness. The vessel's inside diameter is 11 ft. Each unit is tested for a minimum working pressure of 585 psi. Operating temperatures range from 125 to —20 F.



PRESSURE vessel (above) measures 46 ft, 9 in. long; has a 34-in. inner diameter. The fabricator, Foster Wheeler Corp., Mountain Top, Pa., used 2-in.-thick T-1 steel for nine of these vessels. At left, automatic submerged-arc welding joins one of the horizontal seams. Nozzle attachments and other connections were made with E9015 electrodes. Each T-1 plate was grit-blasted prior to fabrication; frequent dye penetrant inspection was used during welding; and a 2,000,000 electron volt machine was used to obtain maximum sensitivity in X-ray film interpretation.

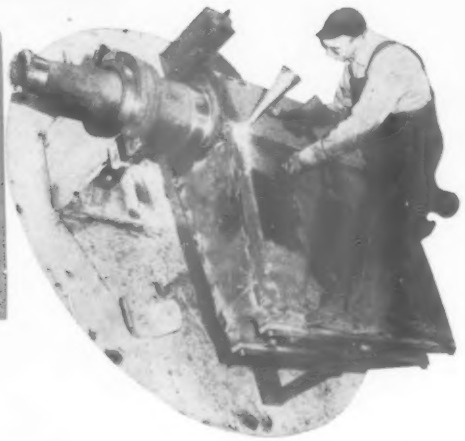


MAIN structures of this Army diesel-electric locomotive are welded T-1 steel to withstand impact of rough Alaskan roadbeds and shock of extreme low temperatures (often —50 F). If built of carbon steel, this locomotive, manufactured by General Electric Co., would crack under the jolts and extreme cold.

Completed coal hauler is capable of carrying more than five times its own weight through use of high-strength steels and welding.

MANUAL arc welding on T-1 rear-axle structure was done with ¼-in. and 3/16-in.-diameter E11018-G electrodes, while submerged-arc welding (below) used 5/64-in.-diameter copper coated CrNiMo wire with a neutral flux.

All-welded coal hauler can carry five times its own weight



DESIGNING a bottom-dump hauling unit to carry the greatest payload with the least possible empty weight required both high-strength steels — and welding.

Built by LeTourneau-Westinghouse Co., Peoria, Ill., this 80-ton-capacity trailer hauls as much coal as 1½ railroad cars and weighs less than most 50-ton-capacity trucks.

The all-welded "Mr. Big" with its extremely high ratio of payload to weight (just over 15 tons) makes it very economical on fuel, tires, and other operating costs.

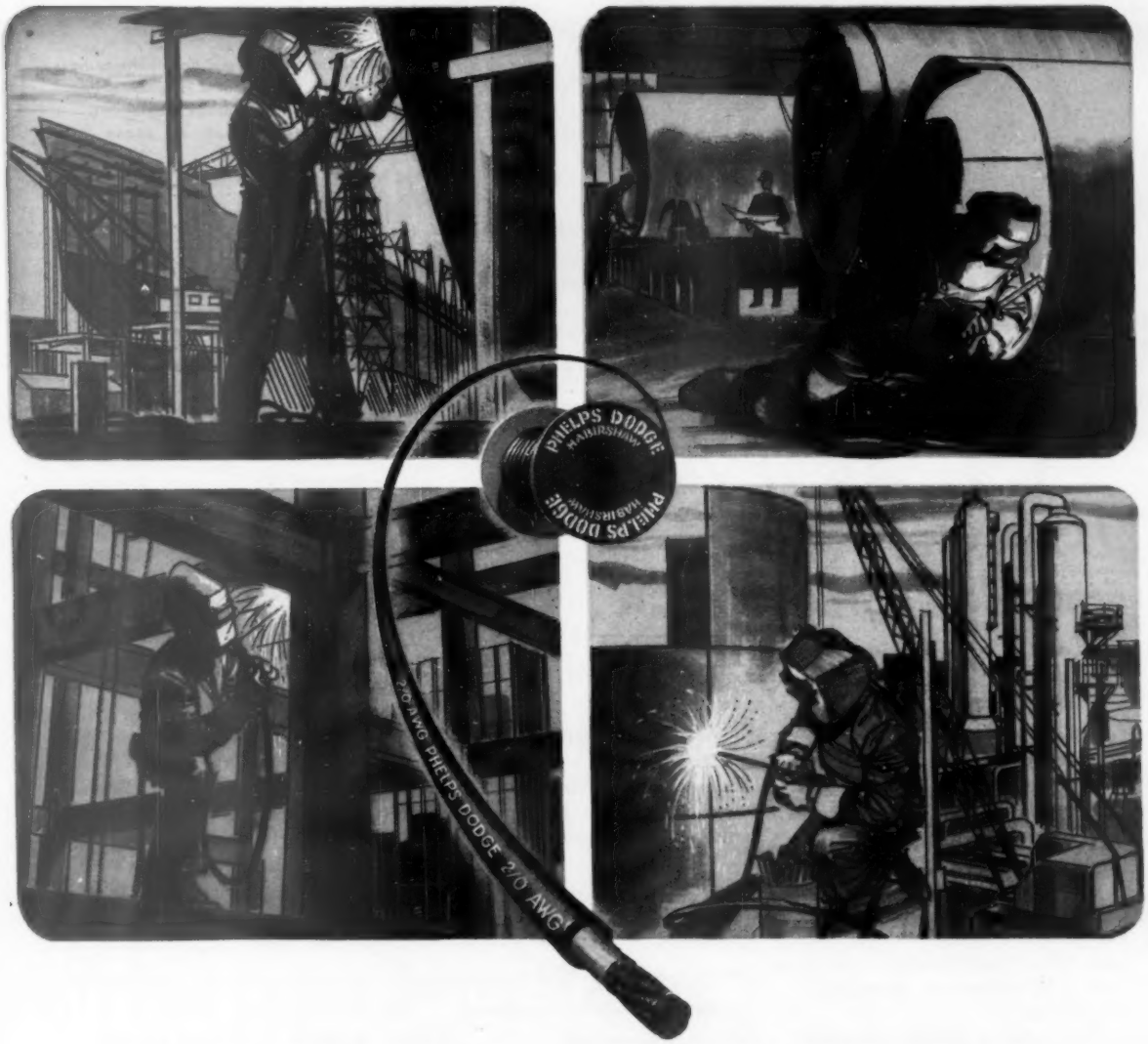
However, this high ratio also necessitated special consideration when fabricating the highly-stressed rear-axle assembly.

Measuring 16 in. by 56 in. by 121 in., the axle structure was fabricated from high yield-strength (100,000 psi minimum) T-1 steel. Plate sizes used were ½-in. and ⅝-in. thick.

Using d-c submerged-arc welding and a-c manual arc welding to join the plates resulted in a lighter-weight unit which would still take the road shocks at 40 mph.

Submerged-arc welding was done with a 5/64-in.-diameter, copper coated CrNiMo wire with a neutral flux. Manual arc welding use both ¼-in. and 3/16-in.-diameter E11018-G electrodes at 350 and 250 amp respectively.

The trailer body was made from U. S. Steel Corp.'s Man-Ten steel. Use of these two steels — plus welding — resulted in a payload increase of 10 tons more than with conventional construction.



Phelps Dodge Habirprene* Arc Welding Cable

lasts longer under roughest working conditions!

The durable quality of Phelps Dodge Habirprene arc welding cable makes it ideal for use on jobs where welding cable undergoes severe physical wear and tear. Records show that Habirprene cable more readily absorbs heavy blows and weights, resists oxidation and damage caused by severe working conditions in shipyards, oil refineries, building construction and boiler-making plants. In some applications, Habirprene cable has lasted many times longer than rubber cable.

More than 10 years ago, Phelps Dodge pioneered Habirprene welding cable—the first real advance in this field. Today's Habirprene welding cable is the result of Phelps Dodge development and manufacturing experience devoted over the years to providing an arc welding cable of superior quality with a proven record for safety, dependability and long life. This cable meets all requirements of A.S.T.M. D752.

See your authorized Phelps Dodge distributor for hard-wearing, long-lasting Habirprene arc welding cable with indelible gold markings. Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All these cables are available from stock.

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GIANT ore hauler and tiny sportscar have two things in common: ruggedness and maneuverability. Carbon dioxide-Mig welded T-1 dump body has 55-ton capacity.

Tests on T-1 Steel include submerged-arc, CO_2-Mig welding

TESTS INVOLVING T-1 steel are being conducted by two different manufacturers — one to test a completed product, the other to improve welding techniques and quality.

In the first testing operation, a new truck for mining operations, designed for exceptional capacity and high maneuverability, is receiving its shake-down cruise as an ore hauler.

This diesel-electric-powered giant, manufactured by Unit Rig and Equipment Co., Tulsa, will carry a payload of up to 55 tons.

Measuring 41-ft long, it can make a full turn in less than 50 ft, speed at 23 mph across a smooth surface, and turn a figure eight in the same tracks as a conventional 15-ton truck having only one-quarter the same capacity.

The dump body, which tilts at 70 deg and unloads in 23 seconds, is fabricated of 1/2-in. T-1 plate for the bottom, sides and front. The wear plate for the wear area bottom, side and front slopes is 5/8-in. T-1 steel.

The unit was welded with a flux-cored, carbon dioxide-Mig welding process manufactured by National Cylinder Gas Div., Chemetron Corp.

The hauler is actually a tractor and trailer, with a kingpin hitch between two 2-wheeled units. Each wheel is powered by an electric motor mounted within the rim.

The second testing operation, conducted by Harnischfeger Corp., Milwaukee, was run as part of a continuing program to improve welding techniques and quality in its welded products.

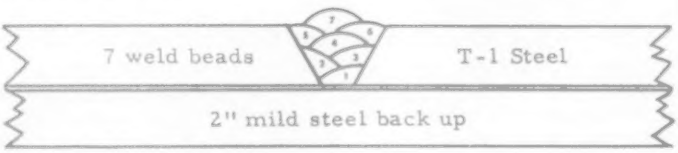
Two 3/4 by 6 by 12 in. T-1 steel test plates were torch cut for a 30 deg bevel and a 60 deg included angle. The plates were then tack welded to 3/4 by 2 by 12 in. mild steel backup bars, leaving a 1/4-in. root opening.

(The large backup bar was to eliminate any chance of burn through.)

The plates were then submerged-arc welded using 3/16-in.-diameter wire manufactured by Page Steel and Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

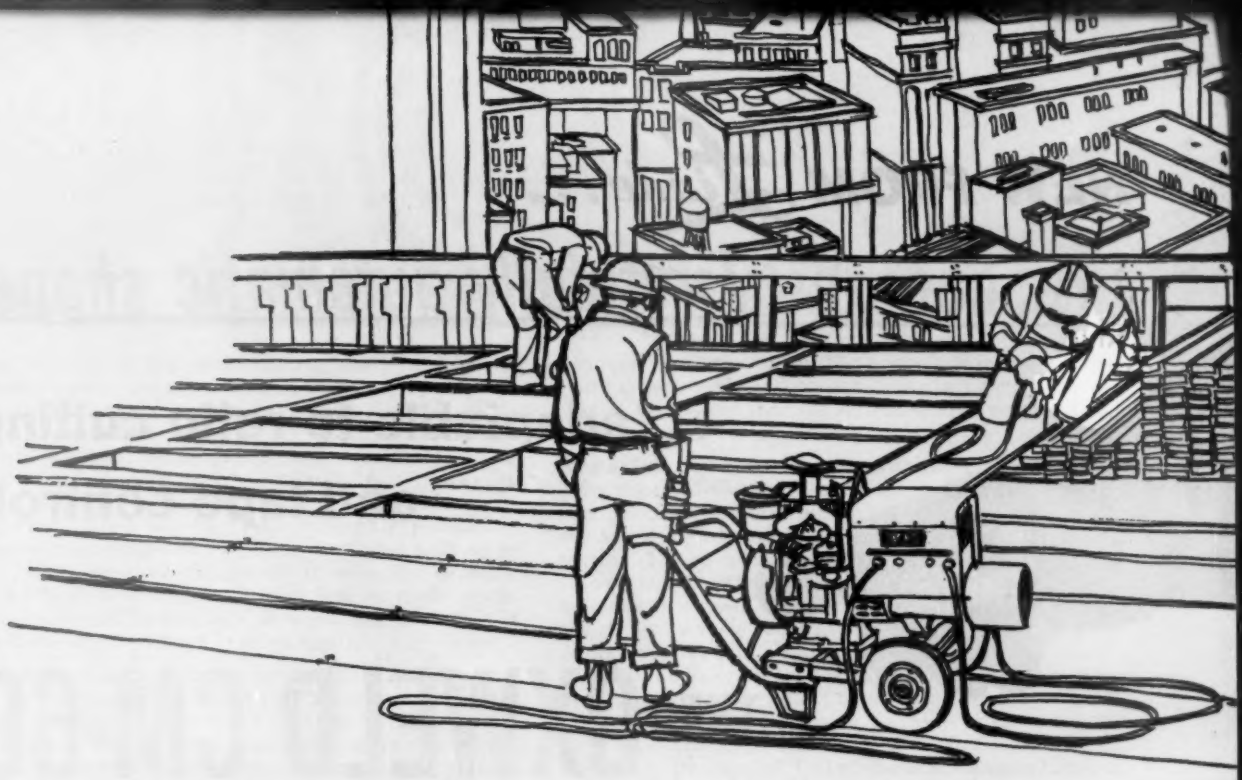
Welding procedures and test results are shown in figure 1. Interpass temperatures were maintained at 200 F by air-blast cooling. Both test specimens broke in weld metal; fracture was good and no apparent defects were detected. Bend tests were not made.

Transverse weld test specimens	No. 1	No. 2
Original dimensions	0.700 x 0.750 in.	0.677 x 0.745 in.
Yield, psi	100,000 lb	104,700 lb
Ultimate tensile, psi	115,000 lb	115,500 lb
Elongation, % in 2 in.	19%	19%
Reduction of area	31.8%	37.0%



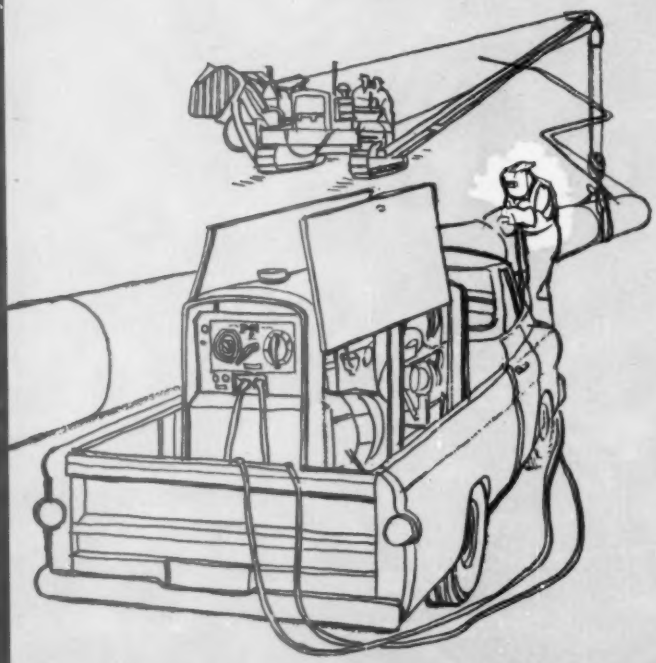
Beads	Amp	Volts	Speed, ipm
1	600	32	13
2	600	32	10
3	650	35	10
4	640	40	10
5	640	40	10
6	640	40	15
7	640	40	15

FIG. 1 — Welding procedures and test results when submerged-arc welding 3/4-in. T-1 steel plate.



WELD 50 STORIES UP... OR 50 MILES FROM NOWHERE

with P&H Engine-Driven Welders



You can use these portable, self-contained welders to save time and work on any construction job *anywhere!* They are ideal for buildings, pipe lines, bridges, or maintenance — wherever you need cost-cutting weld-power to join and strengthen metal parts and sections. You simply haul, wheel, or hoist the welders into position and start welding.

P&H offers you six machines for welding requirements ranging from 25 to 500 amps. Easy, precise voltage control and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts, thus sparing you the need for costly rewelds and call-backs.

You don't have to pamper P&H welders. They're built to withstand hard use and rough handling in the field. They need less care — and they are easier to service. Rugged field-proved gas or diesel engines meet your toughest demands with power and fuel to spare.

You can choose skid- or wheel-mounted machines — with manual or electric starting. Interested? Write for Bulletin W-158.

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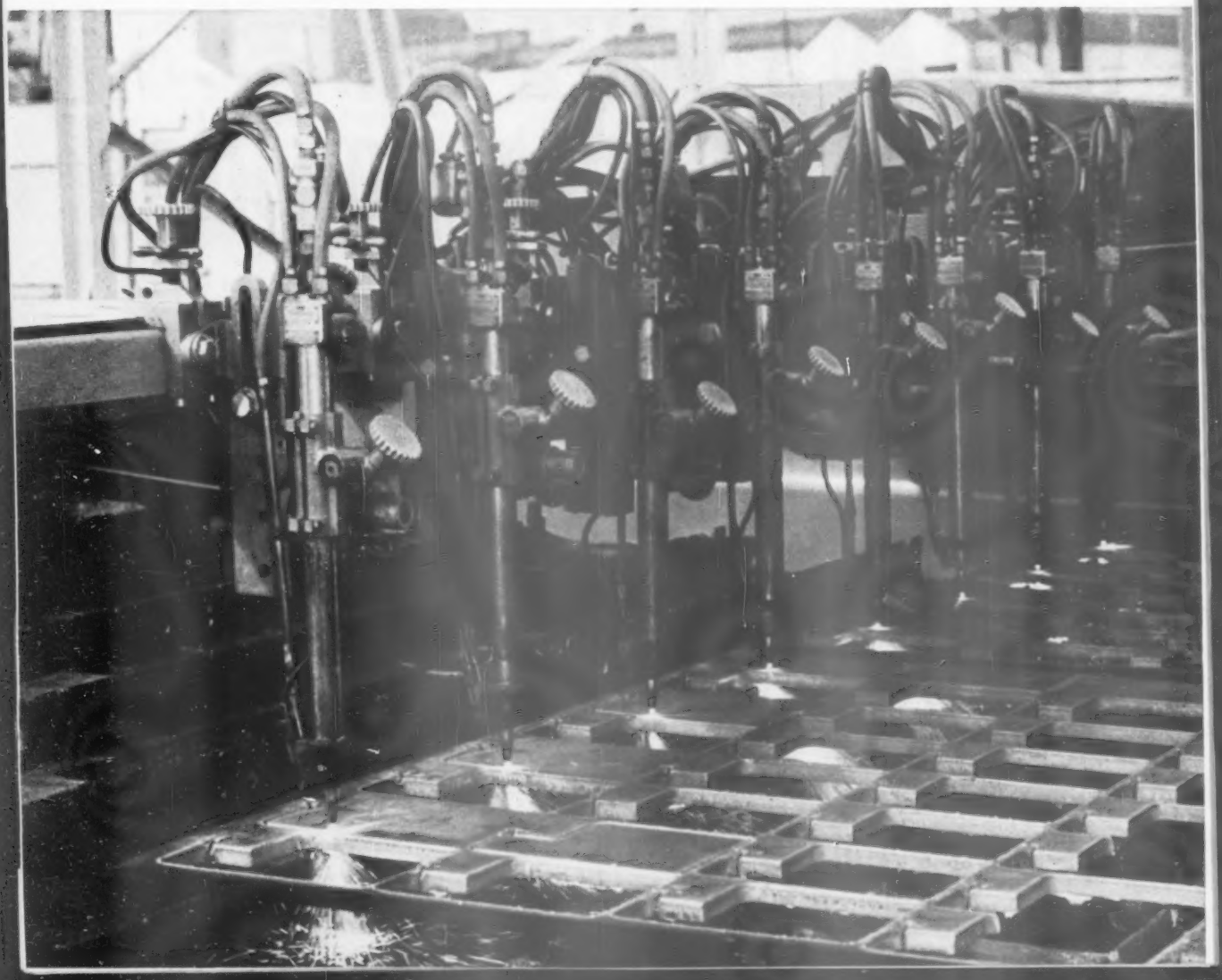
P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING CO., LTD., 455 King St. West • Toronto, Ontario, Canada.

NEW FROM *Linde* . . .

First fully automatic shape-

. . . adaptable to ratio cutting and tape control!

THE OXWELD CM-60



cutting machine with unlimited capacity!

Never before has any shape-cutting machine come so close to complete automation. The OXWELD CM-60 will reproduce thousands of metal parts from a simple exact-size pencil or ink drawing on ordinary paper. It requires only one operator, working at a single, centrally located control panel. Powered by a co-ordinate drive system the CM-60 is readily adaptable to all present and future methods of control including ratio cutting and punched or magnetic tape. Standard models are equipped with up to 10 torches to handle work up to 10 ft. wide. But capacity of the CM-60 is unlimited. Models can be made to cut greater widths. The length of sections that can be cut is limited only by the length of track used.

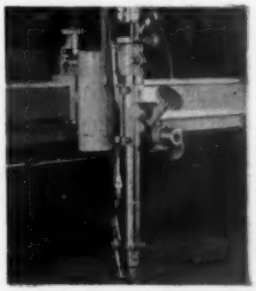
Complete fingertip control—Ignition, preheat, cutting oxygen, height adjustment of the torches, movement of the carriages, positioning of the tracer...every action can be controlled by flicking a switch or turning a dial. Remotely operated ignitors on each torch light preheat flames simultaneously. Piercing of plate is simplified by a unique pilot valve on the panel which turns on the cutting oxygen slowly and gradually to start a cut or pierce a hole. Gases are shut off automatically when cutting operations stop for any reason.

Superior construction features—The co-ordinate drive type CM-60 has power to spare. Each carriage has two individual motors—a high speed motor for positioning and a co-ordinate drive motor for accurate positive cutting. The co-ordinate drive motors are directed by a sine-cosine potentiometer. Only premium quality, durable materials are used throughout. Weight of the CM-60 on the guide tracks is borne at only three points so that the frame won't twist.

Get full details on the OXWELD CM-60 shape-cutting machine from your local LINDE office. Or, write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto 7, Ontario.

LINDE COMPANY UNION CARBIDE

Follows a pencil drawing...First and only tracer with built-in kerf adjustment—The photocell tracer never contacts the tracing table. There is no damage to drawings. You can use simple pencil or ink drawings, completely eliminating templates and their storage problems. In most shops this saving alone will pay for the new tracer in less than a year. Tracer accuracy is excellent—within ±.005 inch. Kerf widths up to ¼ in. can be easily adjusted for on the tracer. Drawing can be simply traced from engineering prints of the desired shape.



Any deviation in plate surface level is instantly sensed by an automatic height adjustment control unit. If there is any deviation in the plate surface the motorized torch holders react instantly, automatically lowering or raising the torch to compensate for the deviation. Cutting oxygen is automatically controlled by quick-acting solenoid valves on each torch to eliminate gouging after the cut is complete.

"Linde," "Oxweld" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

This welding consultant pulls no punches in his estimate of what is wrong with today's shop practices. His views on some solutions sought are sure to arouse controversy.

Do you have a true picture of your fabrication costs?

by **Bela Ronay**

EXECUTIVES WHO HAVE cost-accounting systems in their plants are smug in the belief that they have full control of all operations.

If those operations include welding, however, chances are their cost-accounting system does not provide a true picture. They may know a weldment's fabrication cost, but they do not know the cost of weld metal per pound in that weldment.

The national average for manually deposited weld metal is $3.00 per pound for 3/16-in.-diameter electrodes; $5.00 per pound for 5/32 in. For sheet metal welding using 3/32 and 1/8-in. diameters, the cost runs upward of $8.00.

Welding costs, with reference to cost per pound of weld metal deposited, gives an entirely different picture from final weldment cost.

Consider a sheet metal assembly weighing 300 lb. Base metal at 18 cents per pound is $54.00. The weight of the weld metal deposited is about 2% of the assembly's weight (or 6 lb) costing not less than $48.00, or about 88% of the base metal cost.

For heavier gage assemblies, this cost relationship is not as disproportionate as for sheet metal weldments, but it is often too high to be realistic.

What can the executive do about improving this cost relationship between base and weld metal?

The solution is not merely technological; it is a matter of assigning responsibility. The engineering division should be in charge of planning both design and fabrication methods. The production department should only be concerned with execution.

Planning economic and quality weldment fabrication (including joint design and selection of welding processes and procedures) is an engineering responsibility.

To discharge that duty, engineers must know the fundamentals of welding technology. To be fully informed of available facilities, equipment and skills, they must have full and constant contact with the fabricating division.

In most plants the welding department head is a seasoned technician, not an engineer. Conscientious and hard working as they may be, they lack the fundamentals, application of which makes the difference between high and low costs, and product quality.

Welding starts in the drafting room. Joint design, welding process and procedures are engineering responsibilities. The welding technician has neither the time nor the qualifications to make these decisions.

Under constant pressure for high production rates, all a welding supervisor can do is assign work, provide facilities and prod the weldors. Thus, the ultimate decision as to fabrication details is left to the weldors.

Management often knows this is the case. Yet it is not particularly disturbed because it sees a similarity between the responsibility given to machinists and weldors.

However, the machinist has a four-year apprenticeship, he is versed in his trade's fundamentals. But the weldor is a skilled laborer without any formal training in welding technology. He will apply himself to his best ability without analyzing the job, because he is not trained to analyze it.

When the system occasionaly breaks down and production is halted, a field representative of the welding materials supplier is called to pull them out of the hole.

These representatives are usually experienced technicians who may make the correct diagnosis regarding production of sound welds—but they are not interested in cost-saving suggestions if it means loss of sales.

Their services are often free, and not worth a great deal more than what they cost. This also applies to free services of so-called "welding engineers" of sales organizations. Their work should be limited to their range of qualification—demonstrating the proper use of the materials they sell.

Their recommendations, naturally, refer to production methods making use of their materials. They must do this to earn their living and be loyal to their employer.

Why expect them to divide their loyalty every time they are called to function as free consultants?

Unfortunately, engineering curricula do not include training in welding technology. Engineers must consequently be given on-the-job training to qualify them for welded design, fabrication and application of welding processes.

The Educational Committee of AWS is planning regional courses in welding technology at the engineer level. (**Ed. note:** Such a course — on inert gas and CO_2 welding — was to have been held last month.)

Meanwhile, wise executives may obtain the services of independent consultants to organize and carry out on-the-job training of their engineers in welding technology.

WELDING HIGH PERFORMANCE STEELS?

Proper preheat permits high-quality welds on hard-to-weld low-alloy high-tensile steel. Preheating weldments of almost any size or shape is easy and economical.

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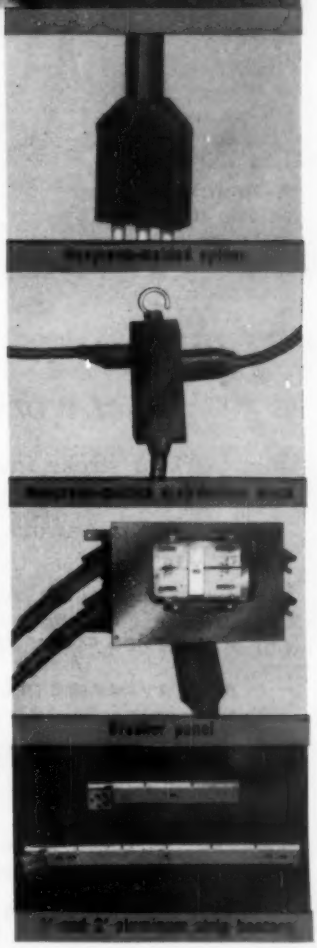
- **Cut costs, save time with a preheat system designed for your welding job.** Assemble installations to preheat weldments of almost any size or shape with interchangeable plug-in units you can use again and again.



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MARKAL COMPANY 3108 West Carroll Avenue, Chicago 12, Illinois

Hose reel provides efficiency, economy

PLANS FOR THE NEW Jennings Repair Yard of the Southern Pacific Railroad at Roseville, Calif., were drawn to eliminate hazards, wear and tear, and time losses sometimes caused by 50- and 100-ft hose and cable lines scattered about the floor of a small work area.

The facility, a one-spot system, can accomodate three cars at a time for necessary welding or other repairs. Cars are moved about by mechanical car pullers operated by push-button controls.

During the designing stage, it was decided to equip each track with a bank of Weldreel hose reels, manufactured by United Specialties Corp., El Dorado, Ark. The bank houses hose for: oxygen and acetylene; journal box oil; air and oil for cleaning journal boxes; center plate grease; compressed air for brake testing and operation of pneumatic tools.

HOSE reel is used for cleaning of the journal box.

These are all mounted overhead, so that tools are instantly out of the way when workmen are finished with them and can be reached when needed with no loss of time.

Rewinding on the reel is powered by a heavy duty retracting spring, the pawls locking every 180 deg and releasing at a slight tug on the hose. Welding machines with reels for handling cable are also installed overhead, contributing to the improvement in safety and economy.

At Kaiser Steel Corporation's Fabricating Division, a Model 30 Iriditron is used to spot-check plate welds on the bow section of a steel barge. Light and easily carried, requiring no outside power supply, the Model 30 uses iridium 192. It can take internal and panoramic exposures not possible with standard equipment.

Remote control of iridium... with Budd Iriditron units

- **Especially designed for remote handling of iridium 192**
- **Excellent for panoramic and internal exposure**
- **Permits exposure of iridium sources by remote control as far as 50 ft. away.**

Skid mounted or portable, this Budd Iriditron unit provides all the versatility of the traditional unshielded source for pipe weld radiography, panoramic exposure of multiple specimens, circumferential and longitudinal welds in boilers and pressure vessels. The unit can hold extremely strong sources . . . as much as 30 curies of iridium 192, approximately equivalent to a 260 KV X-Ray machine. This adds up to significant reductions in exposure times.

And you get complete service from Budd—including radioactive source supply and encapsulation, source replacement and disposal, training for your personnel (at no charge) and aid in setting up complete radioactive facilities.

Write or call Budd Instruments Division for our Gamma Radiography Bulletin . . . or for a consultation on your requirements.

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Quickly— Easily— Economically does

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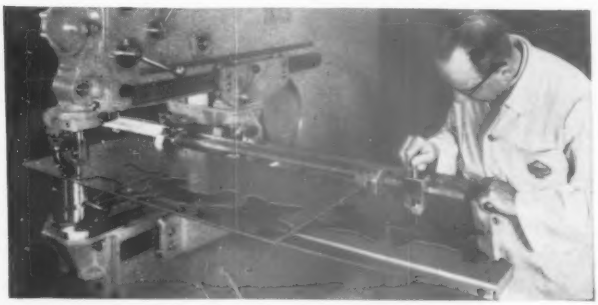

Eliminate high tooling costs:

Sheetmetal is firmly clamped and guided by roller-bearing coordinates as operator effortlessly feeds tracer along template contours. Built-in rulers quickly position sheet for rectangular cuts. Circular cuts to 24" diameter are made through a special swivel ruler.

All-side-cutting punch pierces its own starting hole—cuts in any direction without distortion. Copy nibbles up to 9 gage steel—regular nibbling up to 0.20" steel—shears up to ¼" steel.

Steplessly adjustable stroke and stroke position. Three models—throat depths 41", 49" and 59". Universal forming attachments available.

Write for further information!—Dealer inquiries invited!

COSA

SEE Trumpf Nibblers at the WELDING SHOW

Booth 111 • Los Angeles • April 26-28th

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

Tig process gives all-copper weld for motor connections

A NEW ALL-COPPER WELD for connecting commutator risers to armature coils, thus providing better protection against overload, high temperatures and dirt, has been put into use recently by General Electric Co., Schenectady, N. Y., for industrial locomotive motors and generators.

Eliminating the use of solder, adoption of the new process marks the first use of Tig welding for transportation motors. Since the Tig-welded armatures require no solder, there is no danger of solder melting and throwing as a result of overload, according to the company.

In the new fabrication method, the tungsten electrode produces the arc, which is shielded by inert gas. Since the tungsten is not appreciably absorbed by the weld, the joint between armature coil and commutator is all copper.

Soft soldered joints ordinarily used for this purpose were limited in their application on machines for high-temperature operation because of the danger of solder melting during periods of overload. High-temperature solders and brazing were tried, but found to have drawbacks. The strength of a soldered joint decreases rapidly at

TIG process is used to join coil to commutator.

higher temperatures, while the welded joint strength remains relatively constant.

The company has field tested the new process on trial applications ranging from large motors to high-speed traction motors on rapid transit cars and industrial locomotives.

Now... programmed welding automation from P&H!

with infinitely versatile time-amperage controls.

P&H TAPE-PROGRAMMING completely automates the fusion process and is far superior to human control. Additional channels on tape and reader provide precise control for rotation, wire-feed, gas and water flow, and other related functions.

P&H MOTORIZED RHEOSTAT permits pre-setting of up-slope, welding cycle, and decay at intervals of 6 to 50 seconds—and controls them at exact values. Weld time can be pre-set or controlled manually.

P&H AUTOMATIC SPOT-GUN CONTROL enables operator to pre-set time interval and heat for starting, welding, finishing, and post-flow of gas and water in spot-gun welding. "Add-on" units for existing welders — integral in new machines.

For example, the new P&H motorized rheostat and sequence timer enable you to weld Space Age and other super-critical metals *automatically!* You just dial the pre-calculated heat-time values and press the start button. The control responds with the exact cycles you need for precisely controlled upslope, welding cycle, and decay. The result: perfectly controlled super-critical welding without thermal shock or cracking.

Another modern development is the new P&H punched-tape control for production welding. This industry "first" enables you to tape your jobs today — and weld tomorrow or next month. You can handle more work and get the same top-quality welds regardless of who operates the unit.

Find out today what P&H time-amperage controls can do for you. Send for Bulletin W-155.

HARNISCHFEGER P&H
Milwaukee 46, Wisconsin

Export Division:
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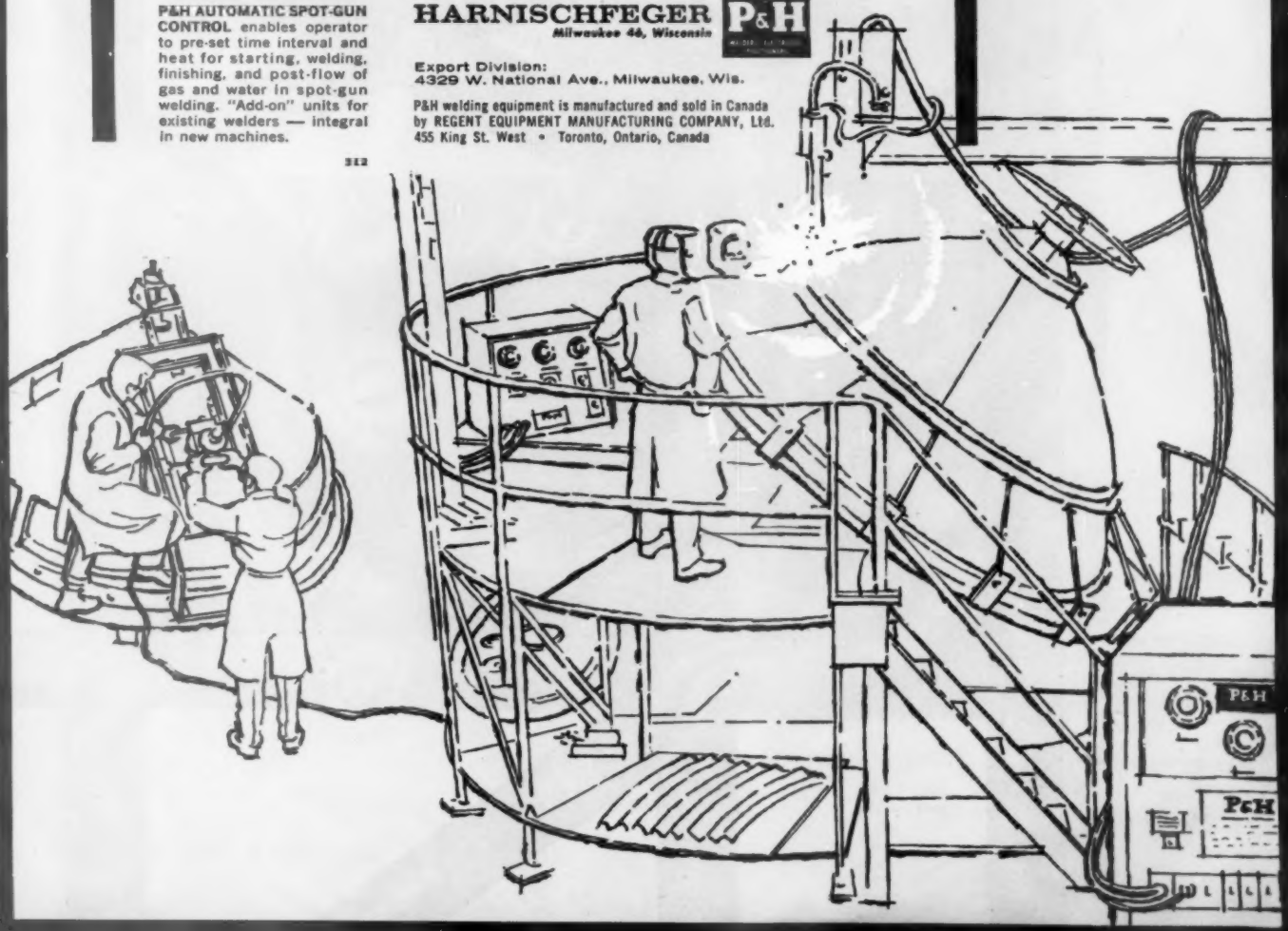


new Westinghouse iron powder-coated electrodes enable

For superior, faster, easier welding, try the new ZIP-10 electrodes—latest advance from Westinghouse research and development. Key to the ZIP-10's performance: a special iron-powder coating that helps boost welding speed . . . makes welding easier because of more spray-type metal transfer . . . permits instant restrike whether the tip is hot or cold. With ZIP-10 iron powder-coated electrodes, welds are smooth, strong, continuous . . . free from breakdowns, pin holes, puffing craters. Undercuts are reduced. Slag is simple to remove. And the ZIP-10 produces outstanding welds regardless of the position in which they are held.

faster welding, instant restrike, hot or cold

Check your nearest franchised Westinghouse welding distributor about the new ZIP-10, one of a series of iron powder-coated electrodes . . . as well as the other electrodes in the complete Westinghouse line. Write Westinghouse Electric Corporation, Welding Department, 4454 Genesee Street, Buffalo 5, New York, for a pocket-sized electrode selector booklet.

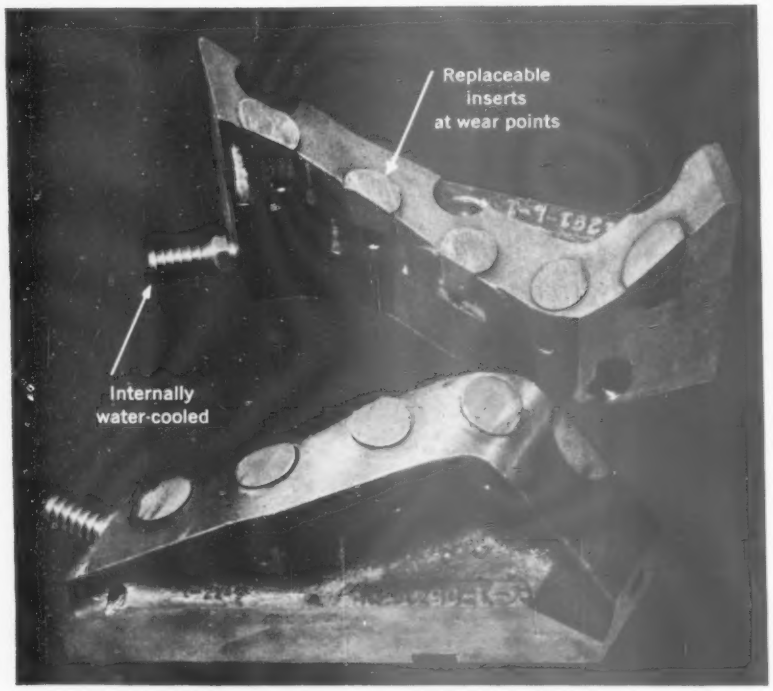
J-10482

watch Westinghouse for new developments in welding

YOU CAN BE SURE...IF IT'S Westinghouse

AMPCO®

7 times longer life for projection welding die!



Replacement time and cost reduced almost 75%!

Originally, the projection welding die shown here was cast to contour in one piece and not internally water-cooled. Its life was short. Replacement was expensive, in terms of both money and downtime.

Then Ampco's experience was drawn upon. Working surfaces were changed to incorporate relatively inexpensive refractory inserts which could be quickly replaced. Adequate water-cooling was provided, also. These two factors vastly increased die life.

Ampco has complete facilities and the know-how for making welding dies of all types — flash, butt, projection, and cross-wire. Your Ampco-Weld distributor can put them to work for you. Call him. Write for Bulletin RW-10.

RW-28

AMPCO METAL, INC., Dept. 187D, Milwaukee 46, Wis.

West Coast Plant: Burbank, California • **Southwest Plant:** Garland (Dallas County), Texas

Hardfacing aid to coal mining

TUNGSTEN CARBIDE hardfacing is extending service life of the bug-duster augers used on coal cutting machines by 27 weeks at the No. 10 Mine of Delmont Fuel Co., Hunkers, Pa.

Discharge ends of augers are the areas of severest wear. Previously, augers were reversed after one end had become worn, this usually being within a five-week period even when using strongest materials.

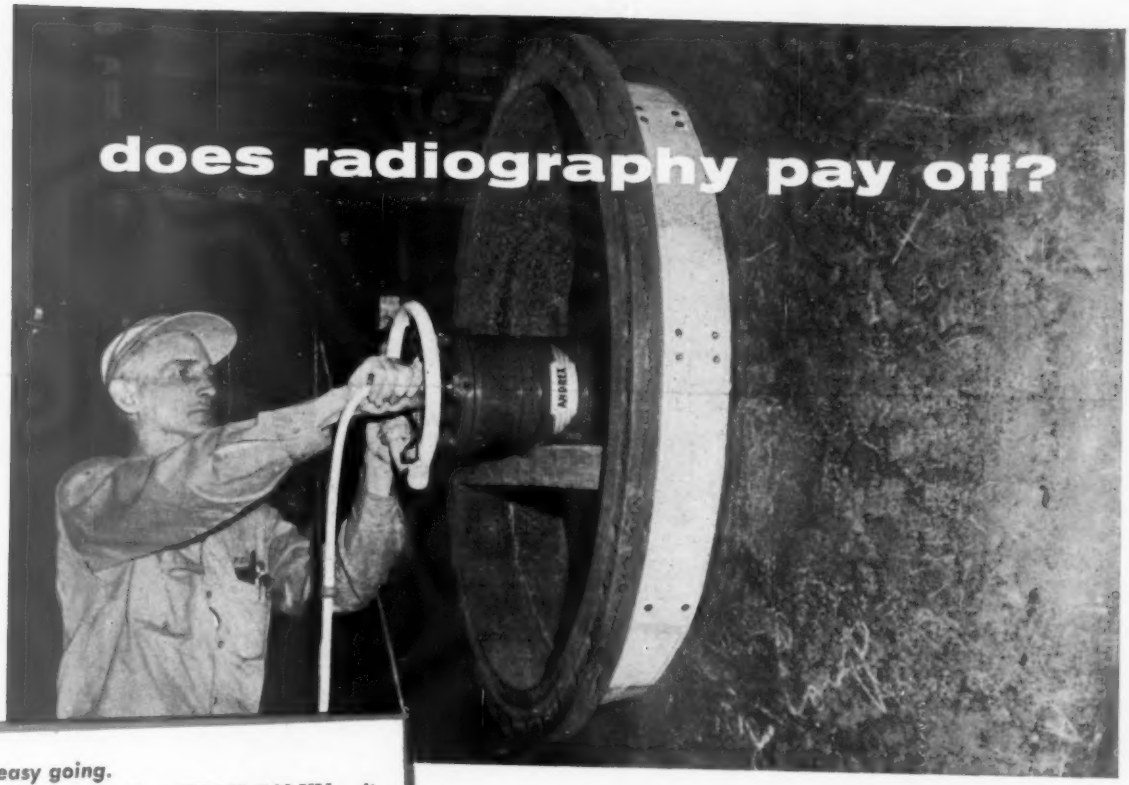
Now, service life of one end has been extended to 32 weeks after hardfacing with a tungsten carbide material. The compound is composed of 60% carbide and 40% steel in the tubes, and was developed by Kennametal Inc., Latrobe, Pa.

Alloy Hard-Facing Co., Greensburg, Pa., did the hardfacing job using standard procedures and an oxyacetylene torch.

Deposits were made on the helical blade's end and a pressure face 180 deg from the discharge end. The cleaned surface was heated to a sweat and the tube melted with an acetylene-rich reducing flame.

Little wear was apparent on the hardfaced section at the end of 32 weeks. Beyond this area, however, where wear had not been a problem in the former maximum five-week service period, notches indicated that hardfacing should be extended more than 180 deg on the 8-in. diameter face and rim.

does radiography pay off?



easy going.
The 64 lb. Andrex FT 360/160 KV unit here emits full-circle radiation: it will radiograph the entire girth weld of a vessel in one "shot". Films are held in place by a snap-on canvas band circling the neck.

x-ray is best for some jobs.
In that case the right machine for you probably lies somewhere in the comprehensive range of x-ray units listed below.

gamma ray (from radioisotopes) is better for others.
With one machine or another in the broad Picker line of isotope units you can radiograph anything from thin aluminum up to 10" thick steel.

unbiased advice free for the asking.
With an equipment line like that (nothing like it in the field) we have no axe to grind for any particular kind of machine: we can *afford* to be unbiased.

Does radiography pay off? Ask steel tank and pressure vessel fabricators—from now on in they couldn't *live* competitively without it.

Look: the new ASME code, Section VIII, ascribes 100% efficiency to a welded joint radiography-proved sound: the weld is considered strong as the mother metal even without stress-relieving. Which means that steel thickness of a radiographed vessel can be less than the thickness of a non-radiographed one.

Ergo: radiography can save tons of steel.
Ergo: radiography saves far more than it costs.

An extreme example? Hardly: hundreds of case records are as dramatic. Call in your local Picker man to find out what radiography (or fluoroscopy, maybe) can do for you. You'll find Picker offices in all principal cities (see local phone book) or write or wire us at the address below.

PICKER X-RAY CORPORATION
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Picker x-ray

one stop for everything in industrial radiography

ANDREX — portable x-ray units—140 KV, 160 KV/360°, 200 KV, 260 KV

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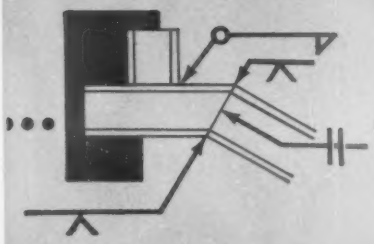
TECH/OPS — units for isotope radiography—sources, equipment, containers for Iridium 192 Cobalt 60 Thulium 170 and Cesium 137

ACCESSORIES — . . . films, tanks, darkroom sundries, illuminators, *everything*



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

More on hardfacing of worn tractor rails

Question:

In the March issue of WELDING ENGINEER [The Welding Clinic] *you presented some general information on hardfacing of worn tractor rails. Could you elaborate on the specific welding procedures to follow?*

Answer:

Assuming the general information from the previous *Welding Clinic* is still available to you, the following is the recommended procedure for hardfacing tractor rails when using an abrasion and shattering-impact hardfacing electrode.

First, clean rails thoroughly of dirt, oil, scale and rust, preferably with a power-driven wire-brush. Then inspect the rails carefully for flaws, spalling and side wear due to misalignment.

After cleaning and inspection, outline the first three links with a stringer pass, forming a border around the entire outside edge of the link. This is done by completing sequence 1 (see figure) on the first, second and third links.

Then return to the first link and complete sequence 2 on all three links. Sequence 3 and 4 follow in the same rotation as shown in the figure. Keep the border pass and subsequent welds ⅛ to ¼ in. from the link end.

After completing the border pass on all three links, return to the first link and proceed with sequence 5 by depositing the required weaving pass across the link to fill in between and join the border on both sides.

This pass is run from the center toward the link end. Then proceed to the second and third links in the same manner. Return alternately to each link completing steps 6, 7 and 8, making certain to follow the welding direction as indicated by the arrows in the figure.

Naturally, there are other procedures for hardfacing tractor rails, but this one is recommended by one firm on the basis of successful applications by average weldors. It is simple and provides the most desirable safety factors.

The chief value of the procedure detailed in the figure is to insure uniform heat distribution throughout every section of the link. This is important in order to obtain the same Rockwell hardness in every part of the link.

Note that the sequence calls for the border stringer pass to be run from the center toward each end. This is to carry the welding heat to the ends of the link where there is more metal thickness so they will cool nearer the rate of the hotter

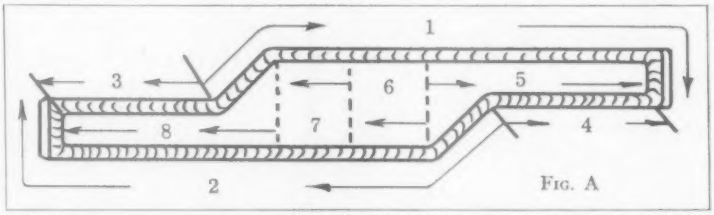


FIGURE shows recommended welding procedure for hardfacing of worn tractor rails.

As mentioned previously in the general information, wide links of large tractors will accommodate a 3/16-in. or even a 1/4-in.-diameter electrode, whereas the smaller tractor links which are much narrower can be handled easily with a 5/32-in. electrode, especially for the border pass.

If a 3/16-in. electrode is used on narrow rails, no fill in room is left for steps 5 and 8, in which case, it would be better to widen the border passes so that they join smoothly to make a finished job without further fill in.

Regardless of what procedure is used, the width of the pass and the size of the electrode should be altered to cover the surface of the link with a smooth deposit of the proper height.

wash pass applied in the center.

If the border stringer pass is started from the cold link end and worked toward the center, it will allow this small deposit of metal to cool too rapidly. The result will be an excessively hard edge.

A second result will be that the welding heat being worked toward the link center will raise the heat level even higher than the normal heat applied by steps 6 and 7, causing a higher differential of cooling rate than is desirable.

When applying steps 6 and 7, be sure the center section is not overheated. When the section being welded appears too hot, as indicated by the metal's color and the weld puddle's fluidity, skip to the next weld.

Got a Welding Problem? Read how . . .

Jones & Laughlin Steel Corporation added 300% wear to Bailing Press Plunger by Hard Surfacing with McKay Tube-Alloy 420-S Wire.

New York Shipbuilding Corporation eliminated three costly steps in welding galvanized plate by using McKay 15 (E 6010-G) Electrodes.

McKay Stainless Welding Wires and Electrodes helped harness a geyser for Pacific Gas & Electric Company.

ABOUT NEW YORK SHIPBUILDING CORP.

New York Shipbuilding Corporation founded in 1899, is one of the three largest shipyards in the United States. The yard has built many of the country's largest cargo, passenger and naval vessels.

APPLICATION DATA

Approximately 30,000 pounds of McKay 15 (E 6010-G) Electrodes were used on this Sub-Assembly which consisted of 51 keel plates. All welding was by manual electric arc.

McKAY 15 (E 6010-G) ELECTRODES

. . . *eliminate 3 costly steps in welding galvanized steel*

New York Shipbuilding Corporation speeded production of Keel and Sub-Assembly installations considerably by using McKay 15 (E 6010-G) Electrodes. These electrodes, conforming to U. S. Navy requirements, permitted successful welding of galvanized steel, where conventional 6010 electrodes failed. Three costly production operations—removal of zinc coating, grinding to bare metal, and regalvanizing after welding—were eliminated.

The savings realized through this more streamlined welding operation runs into many thousands of dollars, because 30,000 lineal feet of weld metal on galvanized steel plate must be made on each ship.

The experience of New York Shipbuilding Corporation is typical of McKay performance. If you have a welding problem, contact the McKay Representative in your area.

McKay 15 (E 6010-G) Electrodes are only one of a complete line of McKay Mild Steel, Stainless Steel and Hard Surfacing Electrodes and Welding Wires. McKay high quality electrodes are first choice with manufacturers of quality products and equipment.

VISIT McKAY BOOTH No. 103 AT AWS WELDING SHOW

See back page for helpful McKay literature

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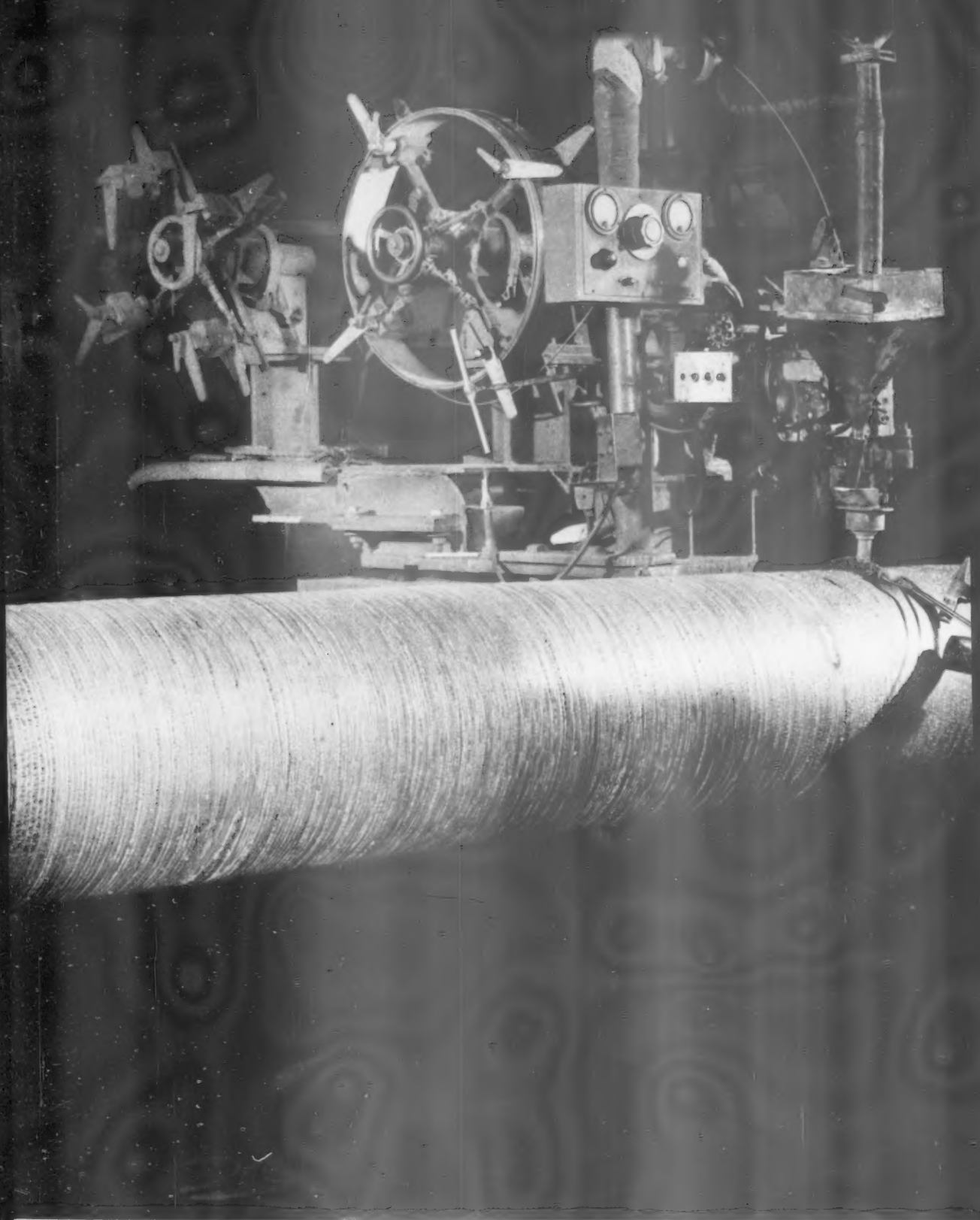

ABOUT JONES & LAUGHLIN STEEL CORP.

Jones & Laughlin Steel Corporation, the nation's 4th largest producer, is a fully integrated steel company combining complete facilities to transform raw materials into semi-finished and finished products. J&L has over 40,000 employees who operate iron ore, coal and limestone mines, three steel making plants, a stainless producing division, fabricating and finishing plants, warehouses, oil country supply stores and sales offices.

APPLICATION DATA

Prior to welding, areas of the plunger to be hard-surfaced were undercut 3/8". The plungers then were preheated to 600°F., and approximately 325 lbs. of Tube-Alloy 420-S weld metal were overlaid on each plunger at a rate of 15 lb. per hour. Sufficient overlay was deposited to permit grinding and polishing.

McKAY

TUBE-ALLOY 420-S WIRE

. . . adds 300% wear to J&L's bailing press plunger

A single Hydraulic Bailing Press Plunger overlaid with McKay Tube-Alloy 420-S weld metal outwore three new plungers, reports Mr. H. I. Samson, Welding Foreman at Pittsburgh Works of Jones & Laughlin Steel Corporation.

The hydraulic press and its components, used to bundle scrap for open hearth furnaces, are exposed daily to terrific punishment and abrasion. Excessive plunger wear was a serious and expensive maintenance problem. Replacement and down-time were frequent and costly.

The plungers surfaced with Tube-Alloy 420-S weld metal decreased replacements by more than 65%. The savings in time and labor were supplemented by greater production efficiency . . . resulting in longer, trouble-free surface life.

"McKay Tube-Alloy wires feed smoothly and evenly, laying down sound, clean, machineable welds," says Mr. H. I. Samson, Welding Foreman at J&L.

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ABOUT OSCAR KRENZ, INC.

Oscar Krenz, Inc. is one of the largest metal working plants in the West. They produce process equipment for food processing, heat exchangers, stills, evaporators, jacketed vessels and prefabricated alloy piping. They also perform special assignments for industrial research and development laboratories, nuclear research organizations and government agencies.

APPLICATION DATA

Weldments were made with McKay 308 ELC Stainless Steel Wire on a semi-automatic welder with submerged arc. Manual welding was done with McKay 310 Stainless Steel Electrodes. Each duct required more than 1,000 lbs. of weld metal.

McKAY

STAINLESS WELDING WIRES

. . . help harness a geyser for Pacific Gas & Electric Co.

Steam Geysers, among nature's most powerful forces, will furnish the power for a steam turbine for the Pacific Gas & Electric Company in the "first-of-its-kind" project in the Western Hemisphere. It is a 12,500 K.W. Power Plant to be in service this summer near Healdsburg, about 80 miles from San Francisco. The 35,500-lb. exhaust ducts from the turbine were welded with McKay 308 ELC Stainless Steel Wire and 310 Electrodes, by Oscar Krenz Inc., Berkeley, California.

Welds in the 7-foot diameter and 70-foot long ducts had to be strong, leak-proof and crack-free. Once installed, repairing would pose major problems. In addition, the high sulphur content in the geyser's water make it mandatory that welds be corrosion resistant.

Mr. Kenneth L. Behneman, Chief Engineer at Krenz, stated, "McKay Electrodes gave us excellent results. According to our welders, McKay Electrodes consistently produce welds of high quality and uniformity. The crack resistance of weld metal deposited by each lot of McKay Welding Electrodes and Wire was determined using standard bend test procedures. Completed ducts successfully passed vacuum leak detection tests."

Become better acquainted with McKay products and services. No matter what your needs—Mild, Stainless, Special Purpose, Hard Surfacing Electrodes and Wires —it will pay you to investigate McKay.

"We get exceptionally good service from McKay. This is extremely important to us because our electrode needs vary with each job," said Mr. Kenneth Behneman, Chief Engineer, Oscar Krenz, Inc.

VISIT McKAY BOOTH No. 103 AT AWS WELDING SHOW

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"HELPS"

FROM THE McKAY COMPANY

Hard Surfacing Catalog

A 20-page catalog containing detailed alloy recommendations and welding procedures for the repair and reclamation of over 500 specific parts of various types of equipment. A useful guide to welders, welding engineers, field service and purchasing personnel.

For your copy circle No. 200 on Literature Request Card.

Hard Surfacing Manual (Earth Moving Equipment)

This manual provides detailed information and procedures for the deposition of alloys for the proper build-up and/or hard surfacing of over 30 illustrated parts used for heavy earth moving equipment.

For your copy circle No. 201 on Literature Request Card.

The Welding of Stainless Steels

A 48-page pocket size booklet which provides a quick reference to data on chemical analysis, mechanical properties, corrosion resistance and types of electrodes available for welding stainless steels.

For your copy circle No. 202 on Literature Request Card.

The Welding of Mild Steels

Pocket size 44-page booklet which catalogs specifications, operating characteristics, properties, uses and other data about McKay Mild Steel, Low Alloy and Special Purpose Electrodes.

For your copy circle No. 203 on Literature Request Card.

McKay Comparison Chart

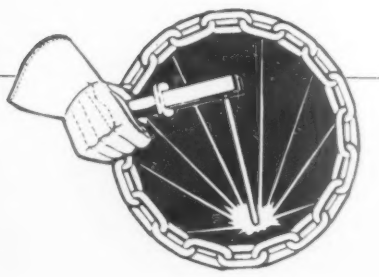
A handy and useful guide in matching brand name electrodes with AWS class or A.I.S.I. grade. Listed are all electrode classifications of The McKay Company with all major manufacturers' electrodes which fall into each individual class.

For your copy circle No. 204 on Literature Request Card.

McKay Selector Chart

A complete guide to the selection and use of McKay welding products including all classes of mild steel, stainless steel, special purpose, hard surfacing electrodes and automatic and semi-automatic wires.

For your copy circle No. 205 on Literature Request Card.



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Litho in U.S.A.

ALUMINUM angle is Mig welded to outer pool wall.

Mig welding helps to build large swimming pool

A MIG-WELDED PRODUCT, the largest swimming pool ever installed in the New York Coliseum recently provided grandstand entertainment to visitors at the Third Annual National Swimming Pool Exposition.

The 55,000-gal. pool, which was the site of numerous swimming races, water ballets, synchronized swimming, and skin and scuba-diving demonstrations, was welded by Chester Products, Inc., Hamilton, Ohio.

Installation of the 30-ft x 60-ft all-aluminum pool was made within 35 hours prior to show time. Chester's three-man team first laid the pool floor sections and joined all seams with a Linde Co. Mig welding unit. Seams were completed at a speed of 20 ipm, using 1/16-in. diameter aluminum wire with an argon gas shield. All welds were vacuum-seam tested using the soap suds technique.

Next, the 30-ft. x 4½-ft. wall sections were carefully positioned and tack welded to the floor. These wall sections contain complete integral piping for the pool, and are constructed of 5050-H34 aluminum alloy plate.

Angular braces of aluminum channel were fastened to the outside of pool walls to make the entire pool assembly self-supporting. Wall sections were then Mig-welded and the floor seam was completed all the way around to insure an entirely leakproof swimming pool.

AS pool fills with water, the Dolphinettes Ballet of Vero Beach, Fla., prepares for action.

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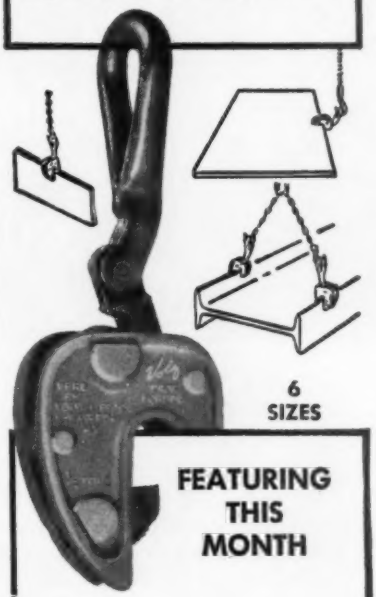

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1-60

Open-web steel frames cut building costs

by **Fred E. Theiler**
and **A. H. Marks***

COMPLETE ALL-WELDED steel building frames, combined with materials such as wood, steel, aluminum or masonry, at less cost than normally expected.

This is the result of a Wisconsin firm's use of open-web, arc-welded rail steel frames.

And the firm, Pruden Products Co., Evansville, Wis., successfully welds its rail steel frames by following some well-defined fabrication procedures.

Rail steel, hot rolled from standard Tee-section railroad rails, is a high-carbon, high-strength steel with sufficient ductility for punching, shearing and welding.

Approximately 50% stronger than medium carbon steel, it affords use of lighter sections and gages for frame fabrication while maintaining required strength.

Actual average yield strength of rail steel is 65,000 psi compared to mild steel's rating of 38,000 psi. Table 1 compares other physical properties and engineering data which further convinced Pruden engineers that rail steel was a proper choice.

Standard engineering practices and many building codes call for a 20,000 psi basic working stress for ordinary structural mild steel. A comparable working stress for rail steel using the same safety factor based on yield strength would be 51.5% more, or 31,000 psi.

To be conservative and provide a high safety factor, Pruden engineers designed the building frames so the rail steel would have a basic working stress of 27,000 psi, providing them with a greater built-in safety factor than with conventional mild steel practices.

Standard frame widths are 30, 40, 50 and 60 ft, each frame spaced 12 ft. or more apart to meet individual requirements. When frames are set 12 ft. on centers, they are designed for a vertical roof load of 45 lb per sq ft.

Special designs are also available for frames having non-standard loading conditions, *e.g.*, crane loads, high velocity wind loads, special ceilings, etc.

Angle sizes used in frame designs are 1¼ by 1¼ by 1/8 and 1½ by 1½ by 3/16 for the lattice members. Main member angle sizes are 2 by 1½ by 1/8; 2 by 1½ by 3/16; 2 by 2 by 3/16; and 3 by 2 by 3/16.

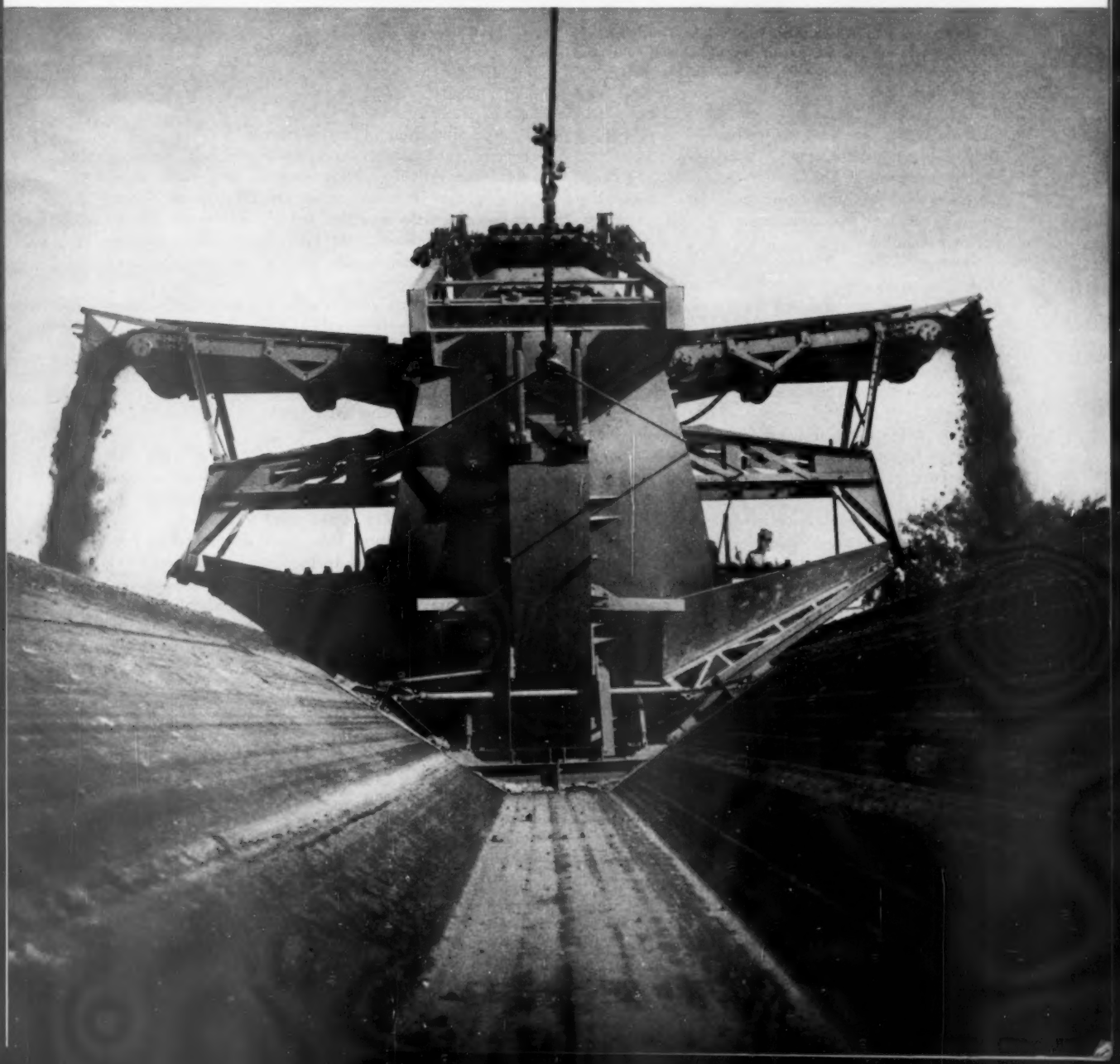
In addition to these angle sections, various size

*Mr. Theiler is welding coordinator and consultant, Madison Vocational and Adult School, and welder qualification inspector, State of Wisconsin. Mr. Marks is chief engineer at Pruden Products Co.

World's fastest ditcher welded with M&T Murex ELECTRODES

This monster machine carves out a continuous ditch 6′ deep, 4′ across at the bottom and 22′ across at the top, at the rate of 7′ a minute. Working at its top capacity of 800 cubic yards of earth an hour, the ditcher could keep a large fleet of dump trucks mighty busy. To give its all-welded frame superior rigidity for uniform digging, Gar Wood Industries used Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

MUREX
PRODUCTS FOR BETTER WELDING



FRAME fixtures are designed so the work will be 3 ft off the floor to avoid chilling air currents during welding. Traveling crane moves welded frames while monorail crane unloads full lifts of steel.

plates and bars are used, as well as ½ in. and 5/8-in. rods as bracing members.

Lattice members are smaller than principal chord members and are welded on both legs where they connect. Welds are continuous at contact points between members.

Fillet weld size is 3/16 in. in most cases, or larger when necessary. Weld size, placement and quality of each frame are checked by an inspection crew prior to painting.

Because of their size and shape, building frames must be shipped in sections and field splices must be located with least effect on the assembly's strength (point of zero moment).

Figure 1 illustrates the distribution of moments in a typical frame with the point of greatest moment in the knee section area.

The welding of steels in the medium to high carbon range (rail steel ranges from 0.50 to 0.80 carbon) requires carefully applied techniques along with full recognition and understanding of the problems.

The basic problem in welding rail steel lies in the somewhat higher hardenability of higher carbon steels.

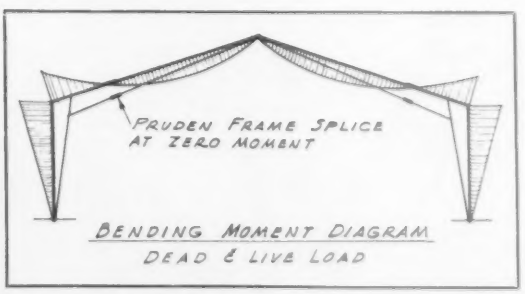


FIG. 1 — Distribution of moments in a typical frame with the point of greatest moment in the knee section area.

A combination of various techniques is used to control hardenability and produce sound welds of sufficient ductility. These are: careful stock handling, proper mounting and assembly, joint design, proper electrode selection, welding techniques, proper welding equipment and operation, weldor training and qualification, quality control, and research and testing.

For consistently good results it is necessary to have clean stock, free from oil, loose scale, dirt, etc. All rail steel stock is moved into the fabrication shop and stored at room temperature for at least 48 hours before setting up for welding.

This eliminates the quench effect cold stock would have on subsequent welds.

All frame fixtures are designed so the work will be 3 ft off the floor to avoid any chilling air currents during welding. Fixtures are also designed to avoid tight clamping of rail steel sections.

Welding procedures have been developed to permit 75% of all welding to be done in the downhand position, with the remaining welds done as follows: 6% horizontal, 6% vertical and 13% overhead.

Butt, lap and edge joints are used in welding the frames. Necessary welding across the grain at right

Rail, mild steel compared

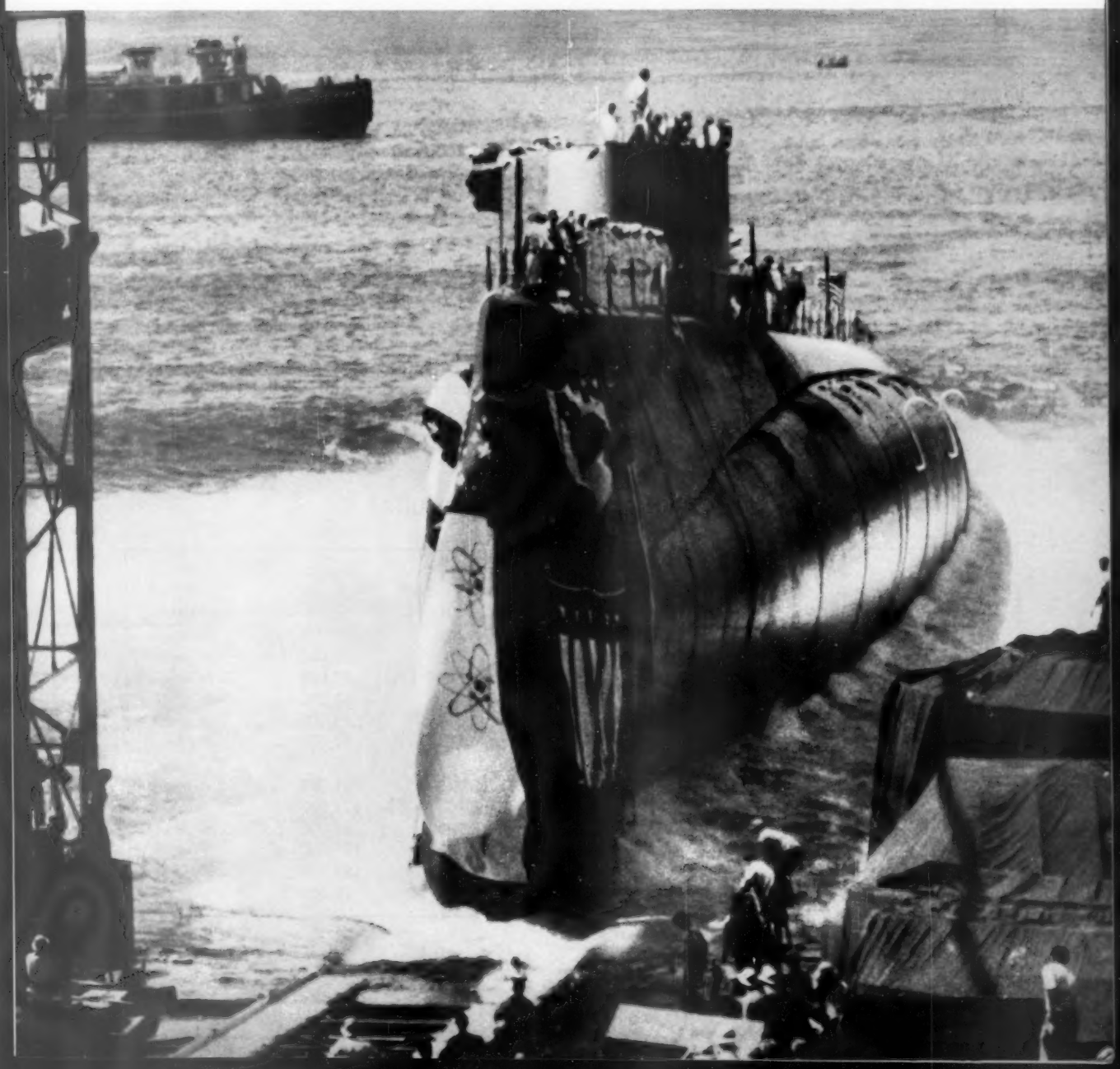
	ASTM 16 rail steel	Mild steel
Yield point, min. psi	50,000	33,000
Tensile strength, min. psi	90,000	60,000
Elongation in 8 in., min. %	10	21
Modulus of elasticity	29,000,000	29,000,000
Endurance limit, psi	42,000	28,000

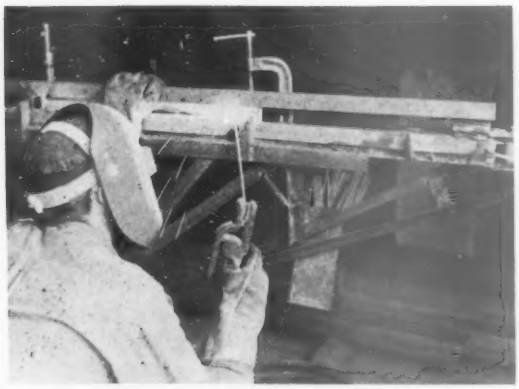
TABLE 1 — Comparison of other physical properties and engineering data between rail steel and mild steel.

World's biggest submarine welded with M&T Murex ELECTRODES

The U.S.S. Triton—launched in May 1958, commissioned in November 1959—can travel completely submerged for more than two months with a crew of 148. This atom-powered giant, built by the Electric Boat Division of General Dynamics Corp., is three times heavier and 40% longer than conventional World War II subs. Construction consumed some 200,000 pounds of Murex electrodes — products of METAL & THERMIT CORPORATION, General Offices: Rahway, N. J.

MUREX
PRODUCTS FOR BETTER WELDING





WELDORS for the firm must pass the requirements of the Wisconsin state building code as all-position weldors.

angles to the direction of rolling is kept to a minimum. All butt joints are welded from both sides for 100% penetration.

Electrodes used are E7017 and E7016 with 1/8 and 5/32-in. diameters. Maximum weld strength and impact resistance are obtained by using the low-hydrogen electrodes, which are stored in a dry oven kept at a proper reheating temperature.

Electrodes are issued in sufficient quantities to last not more than approximately two hours at a time. A-c current is used with amperages ranging from 30 to 300.

Since no detrimental effects have been experienced due to excessive weld hardenability on the rail steel, no preheat is used, all welding being done in the ambient atmosphere of 60 F or more inside the plant.

To minimize bead shrinkage due to cooling, weld beads are made slightly convex. By using a decreased amperage setting, a low penetrating technique is accomplished, and where more than one pass is required, as large a bead as practical is deposited on the first pass.

The bead is immediately cleaned and the second bead deposited while the first is still heated. A short arc is used with a lead angle of not more than 15 deg.

Weldors are selected on the basis of their desire to master welding techniques. Many of these have been hired because of past employment as weldors, while some others have been hired directly from training at Madison Vocational and Adult School as qualified structural steel weldors.

Others have been working in the plant and have taken a welding training course offered by Pruden in cooperation with the school.

In Wisconsin all welding for structural steel buildings is under the jurisdiction of the safety inspector for the Wisconsin Industrial Commission.

Hence, company weldors must pass the requirements of the state building code as all-position weldors. (Wisconsin has adopted the AWS Standard Code for Arc and Gas Welding in Building Construction.)

A series of typical weld samples tested at the University of Wisconsin testing laboratory showed results which fully justify Pruden's design and fabrication of open-web rail steel frames.

Samples were made up of standard rail steel stock angles and were welded under typical plant conditions using low-hydrogen E7016 electrodes. Table 2 shows the test results.

By following these procedures, the firm has successfully met the problems of fabricating all-welded steel frames on a production basis.

In installations throughout the country, the frames have proved their ability to meet rigid building code standards—providing efficient, safe, economical roof framing for many different types of buildings.

Welded rail steel test results

Weld type	Specimen no.	Ultimate Load lb	Elongation in 2 in.	Weld strength lb in.	Nominal weld stress psi	Location start of failure
A	1	11,060	0.12	5,530	83,300	in angle
A	2	9,560	0.05	4,780	72,000	in weld
A	3	11,560	0.05	5,780	87,000	in angle
A	4	10,740	0.05	5,370	81,000	in angle
A	5	12,100	0.05	6,050	91,200	in angle
	Average	11,004		5,502	82,900	
B	1	8,020	0.03	8,020	121,000	in angle
B	2	8,900	0.06	8,900	134,000	in angle
B	3	8,980	0.04	8,980	135,000	in weld
B	4	8,400	0.03	8,400	127,000	in weld
B	5	8,230	0.05	8,230	124,000	in weld
	Average	8,506		8,506	128,200	

TABLE II — Test results of standard rail steel stock angles welded under typical plant conditions using E7016 electrodes.

World's toughest test withstood by M&T Murex ELECTRODES

Behlen Frameless Metal Buildings have survived what's probably the world's toughest single test—a nuclear explosion. One of the prefabricated buildings was placed only 6,800 feet from blast center and remained erect. A duplicate building 15,000 feet away suffered almost no structural damage. In welding the components used in constructing churches, plants, schools, supermarkets, commercial and farm buildings, Behlen Manufacturing Company relies heavily on Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

MUREX
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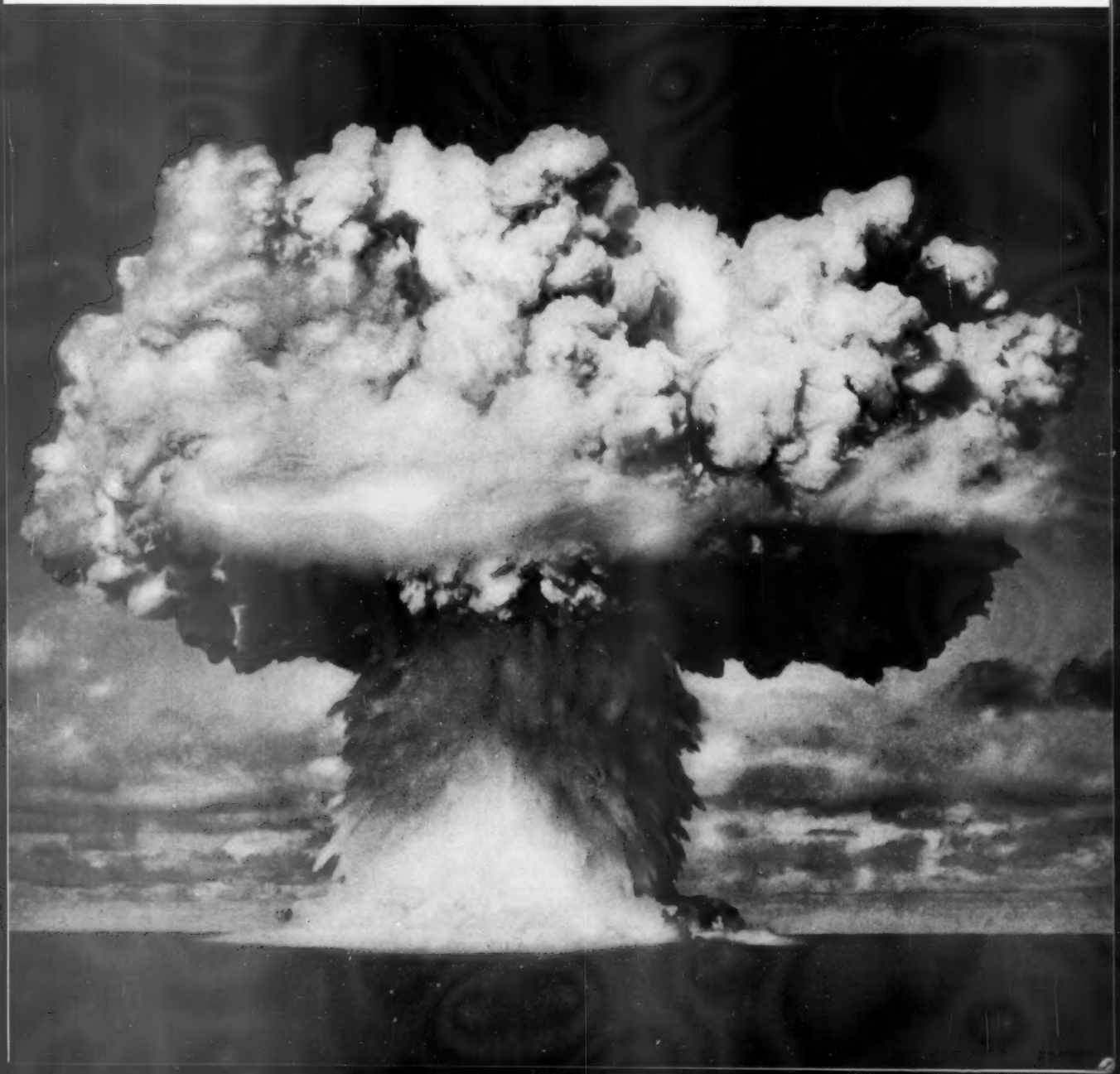
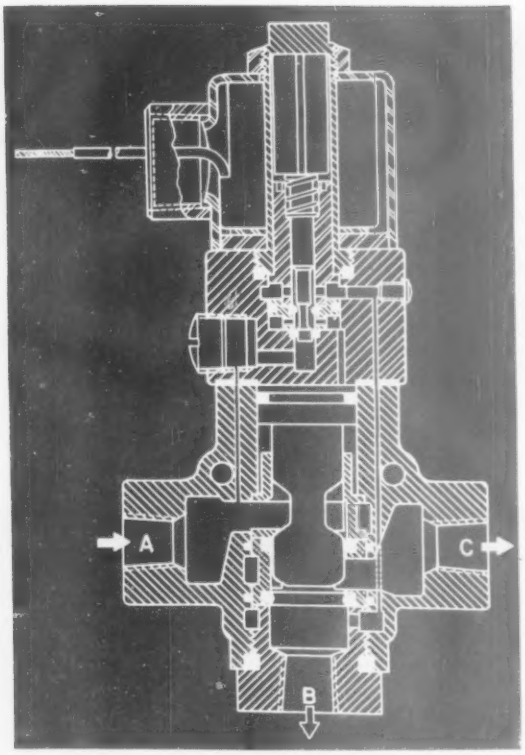
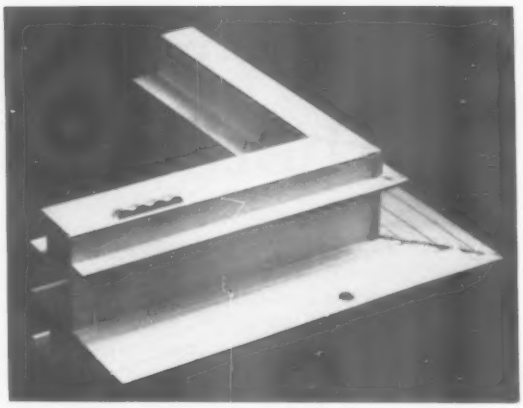






SECTION view (left) of pilot-operated valve in normally closed position can be changed to normally opened position by changing the pilot valve mounting 180 deg. Window frame corner (above) shows completed sections after mitre flash welding.

Pneumatic equipment speeds aluminum flash welding

by **Richard W. May***

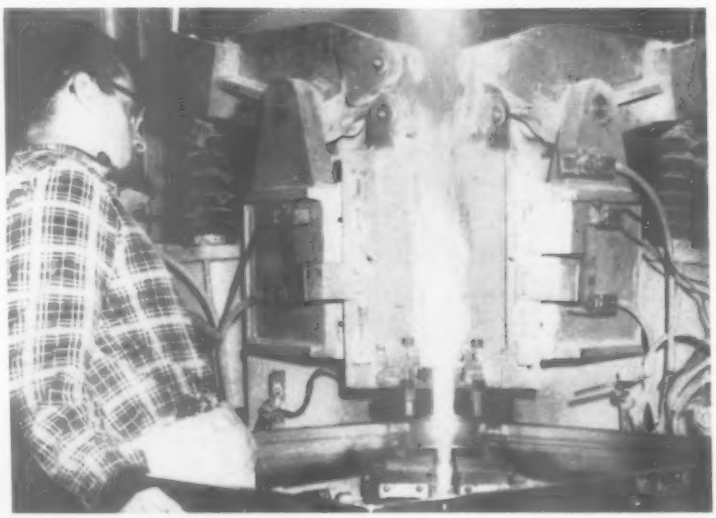
A PRODUCTION INCREASE of more than 100% was realized with the installation of special pneumatic controls on mitre flash welders used to fabricate aluminum window frames.

As many as 6,000 frames had been made in one day at General Bronze Corp.'s Alwintite Div., North Dighton, Mass. However, installation of pneumatics enabled weldors to increase their production rate to about 160 mitre welds per hour.

The clamping and unclamping operations inherent in flash welding are speeded by eight three-way pilot-operated solenoid valves manufactured by Airmatic Valve, Inc., Cleveland.

Two valves control each of the cylinders whose pistons operate the clamps holding the aluminum sections in the welding machine. The same valve is used on each side of the piston even though normally-open and normally-closed valves are required.

The valve can be utilized in this way because changing the pilot valve's mounting 180 deg changes the valve from normally open to



WELDORS can make about 160 corner welds per hour on aluminum window frames, a 100% production rate increase because of pneumatic controls.

*Mr. May is sales engineer with Schaal Associates, Inc., Lexington, Mass.

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All-State provides the right alloy, right finish, right flux, and the right service so you can join any commercial metal to any other—on production line or in maintenance.

If you have a welding, brazing or soldering problem (automatic or manual) there is an answer among All-State's specially produced alloys and fluxes.

This answer may be as near as the nearest of over 1000 All-State distributors here and abroad. Or just write or phone (WHite Plains 8-4646) our Technical Department and Laboratories, White Plains, N. Y. A few minutes and a few pennies might save you thousands of dollars.

To help you know the line and select the alloy and flux best suited for each job, All-State publishes a 56-page INSTRUCTION MANUAL, free to interested users. Also, a special ALUMINUM MANUAL containing 36 pages of data on aluminum alloys and how to join them. If you work with aluminum, ask for a copy.

To serve you, All-State maintains 3 factories, 4 warehouses (White Plains, N. Y.—St. Louis, Missouri—South Gate, California—Toronto, Ontario, Canada) and a central Technical Department and Laboratory at headquarters.

All-State ALL-STATE WELDING ALLOYS CO., INC.
WHITE PLAINS, NEW YORK
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a normally closed position.

The fast action of the clamps starts with the valves. The pilot-solenoid valves have no exterior pneumatic connections and there is no long movement of pilot air since it is right at the solenoid. The pilot air comes through a 1/8-in. passage from the inlet side of the main valve to the bottom of the plunger operated by the solenoid.

When the solenoid moves the plunger, air flows past it and through another passage to the top of the main valve spool. The air then forces the spool down and, depending on which port is inlet and which is exhaust, opens or closes the valve.

Plunger movement (only about 1/8 in.) plus the short pilot-air line produce a high-speed spool response. Maximum power consumption of the 1/2-in. valves is only 10 watts, providing maximum solenoid service life.

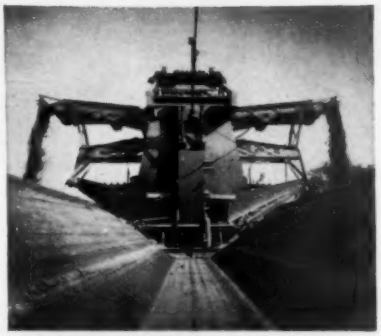
The plunger and the spool are the only moving parts, and chambers on the outside of the spool-guide enable the valve to provide full capacity flow.

Gages on the welder indicate air pressures: one indicates pressure being applied to close the two vertical clamps; a second indicates pressure being applied to close the two horizontal clamps; and a third indicates air pressure on all air cylinders to open the clamps.

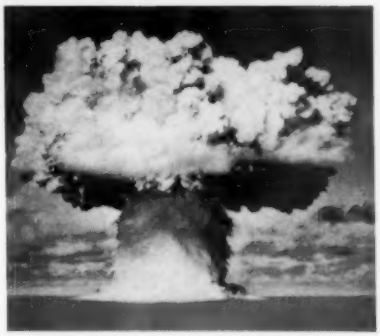
Two foot switches are used to close the clamps, giving better alignment of the two frame sections to be welded. (One section is clamped rigidly in position and the other aligned before the second clamp is closed.)

The 200 kva welder is equipped with both palm and knee switches to open the clamps. Weldors may use whichever is more comfortable and gives the greatest speed (most use the knee switch). Limit switches on the front of each clamp insure that clamps are in position before the welding cycle continues.

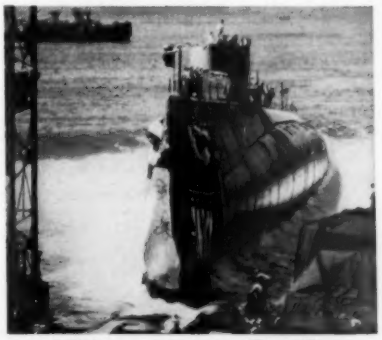
Mitre flash welders are being widely used in many industries, and most can benefit from the increased production rate provided by high-speed pneumatic valves.



Fastest Ditcher



Toughest Test



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ATTENTION: Be sure to visit Booths 603-604 during Welding Show in Los Angeles April 26-28 where you can enter the BIG M&T CONTEST FEATURING A 1960 AUTOMOBILE AS THE PRIZE.

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SPIKE power welding can qualification-weld ⅛-in. aluminum strips, with use of about one-tenth the power of conventional welders.

Spike welder uses short pulse, low power to join coated metals

A NEW TYPE "spike" welder, capable of 500 welds per minute, plus blemish-free welding of coated metals and 1/8-in. aluminum pieces, promises a possible breakthrough in solving many difficult welding problems.

Normally, joining 1/8-in. aluminum stock requires 200 kva welders. In many areas, this amount of power is not available; and, where it is, a transformer must be adjacent to the welder. Engineers of the Weldex Div., Metal/Craft Co., Detroit, manufacturers of the new device, feel that a ten-fold power reduction will bring qualification welding of aluminum within grasp of plants in areas of low power availability, and to plants unable to invest heavily in large welders of restricted use.

The new machine produces 100,000 plus ampere pulses of approximately one millisecond duration, yet requires no additional service lines.

Because it has minimum electrode temperature build-up, the unit is said to reduce electrode pickup on aluminum and zinc-coated metals, thus reducing downtime for cleaning electrodes.

Standard units, with Robotron Corp. controls, have been doing actual field welding for several months, but general availability has been held up pending results from these first applications.

At a special showing for automotive engineers, the company exhibited examples of welds on vinyl-clad and lacquer-coated steel. Studs, clips and brackets were welded on the steel without damage or discoloration to the coating.

Other similar successful applications include the welding of chrome and copper plated metals, dissimilar metals and nonferrous metals.

The unit is capable of critical welding of small parts, where too much heat would damage the enclosure, or perhaps delicate electronic contents. One of the first such installations was for an eastern transistor manufacturer. With conventional welding techniques on joining the case and base, the firm was getting 20 to 30% scrap due to excessive heat. This loss has been practically eliminated.

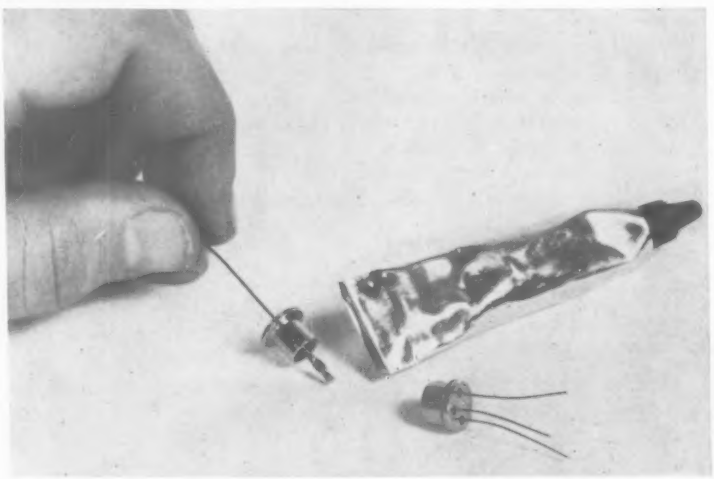
This is due, according to the firm, to the extremely short time duration of the welding pulse, which prevents the heat from penetrating any further from the shell.

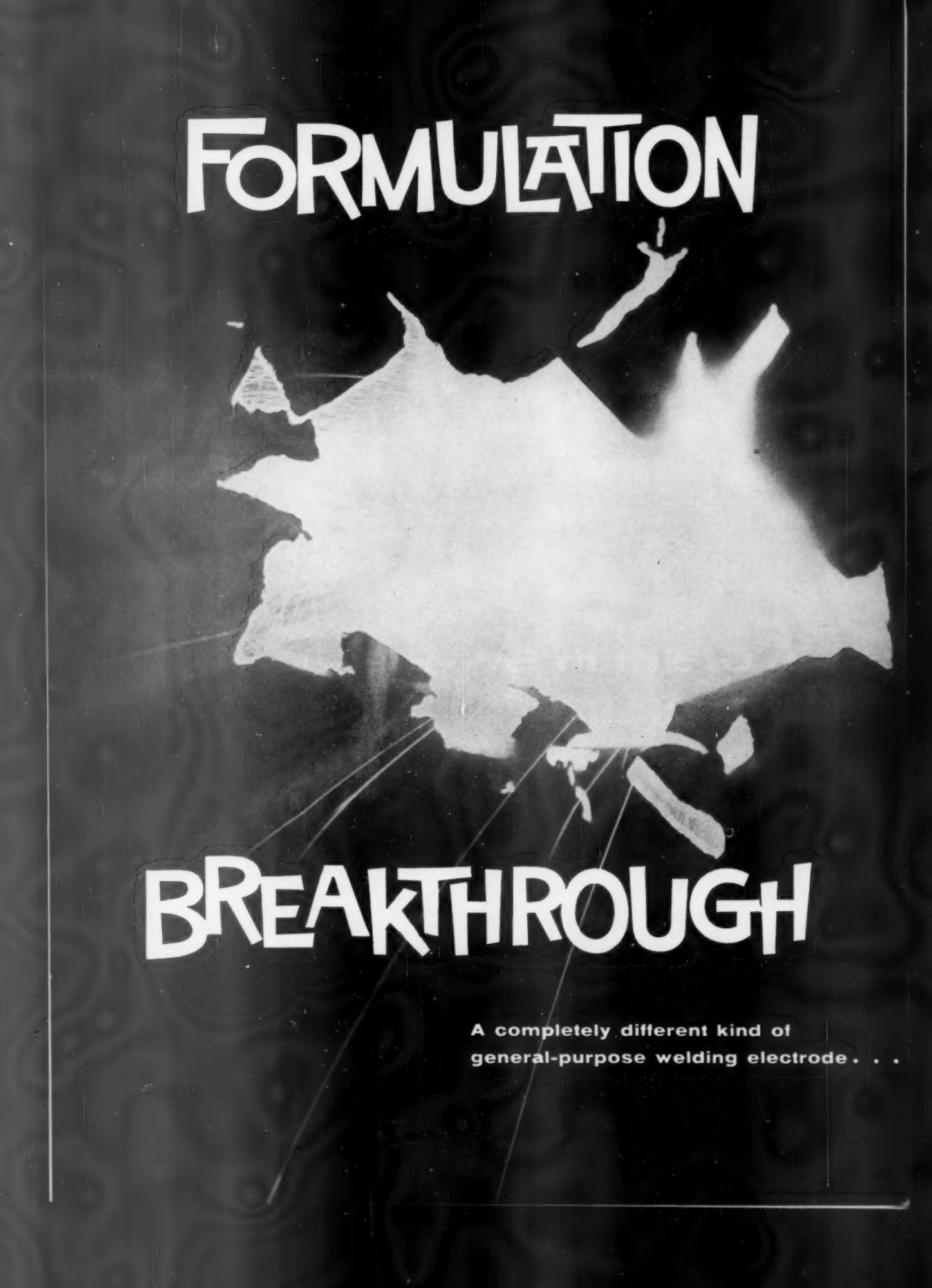
Capacitors are arranged in such a manner as to give 120 pulses of short duration current every second. Thus the weld transformer can be used to handle much greater peak power than when welding on straight 60 cycles. The line demand is correspondingly low.

With capacitor discharge welding, the short time-large power action produces less heat in the weld area. The greatest amount of generated heat is right at the surface to be welded.

The company plans to display the spike welding units at the AWS Welding Show in Los Angeles, April 26-28.

AMONG parts successfully welded with spike power welder are transistors, diodes and pharmaceutical containers.

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A. O. Smith SW-612 – hottest news

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*A. O. Smith introduced the first paper-wrapped electrode way back in 1919.

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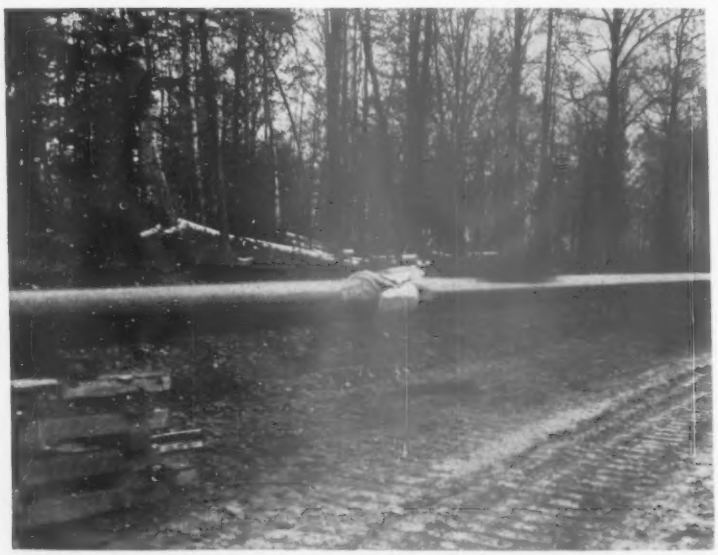
Muffler furnaces normalize pipe welds

. . . and asbestos covers also help in fabrication of gas storage and recovery line

by Elton Sterrett

WELDS shown have undergone heating and "hold" cycles, and are being opened to allow cooling to atmospheric temperature. Asbestos batt conserves heat and slows cooling until desired time has elapsed.



PARTIALLY completed weld, wrapped with asbestos to preserve heat in metal until the next team of weldors can take up the job.

A NATURAL GAS storage field, in which gas would be stored under a pressure of 5,000 psi, introduced problems in pipeline construction rarely met even in high-pressure lines for plant use.

Since the Leidy field, near Donora, Pa., was to be covered by a grid of pipe for storing and recovering the gas—the same pipe serving both purposes — design specifications called for wall thicknesses up to 1.312 in. on the 12¾-in. size main or backbone line down to 0.718-in. on the 6-in. laterals.

Pipe used in construction of the line, operated by New York Natural Gas Co., was National Tube Co. grade B. Mill lengths were double-joined in the yard area of the compressor station.

Conventional pipeline welding was followed. The 30-deg. bevels were first tack-welded, then the weld area built up by six successive passes. Eight weldor-helper teams were used on these welds to provide relief and enable the work day to begin as soon as light permitted.

The pipe ends were first preheated to 400F before being abutted and tack-welded. This heat was then conserved between passes as much as possible by wrapping the partially completed weld with a batt of asbestos, shielded by aluminum foil on the outside for better protection and heat retention.

Following completion of the welding operation and an x-ray check of weld quality, the welds were normalized to eliminate any internal stresses which might have been introduced during the protracted welding operation.

For this process, the contractor, Harford Bros., designed a muffle furnace which could be placed around the weld area. The furnace consisted essentially of a drum-shaped steel shell, split along one diameter and with the center cut

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- SAVE UP TO 50% in LABOR COSTS!
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*A typical package of the 3 pieces of Ransome equipment you'll need is illustrated here. The Model 25 Positioner ($1885) will handle sub-assembly work up to 2500 lbs. The Model 66 Manipulator ($2560) will allow girth welds up to 8 feet in diameter and longitudinal weldments up to 6 feet. Both the positioner and the manipulator give you accuracy to ±1%. Ransome's Model A Power and Idler Rolls ($1405) easily handle vessels up to 4 to 5 tons. Add your power source and welding head and you're automated. Of course there are other combinations to fit your own requirements . . . let Ransome demonstrate how inexpensive automation can be.

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The first 3 phase SILICON Rectifier with electric control of amperage. Has wide range of current and three position range switch with generous overlap. Reversing Polarity switch is standard equipment. *Hermetically* sealed SILICON Rectifiers prevent contamination. Non-aging characteristics of SILICON develop full power output for life of machine. High 98% efficiency of silicon cells provides smooth arc stability. Forced air ventilation and thermal safety switch prevents overheating.

200-300-400 Amp
60% Duty Cycle

THE MID-STATES *Magna-Tran*

AC/DC INERT GAS ARC WELDER

New PLUG-IN timer control: pre-flow — post flow — high frequency drop out and SPOT-ARC. Convert to inert gas welding in the field by plugging in proper timer. SILICON FULL WAVE RECTIFIERS provide superior welding performance on D C application. Patented saturable shunt transformer permits remote and panel control of amperage by rheostat dial. No moving parts reduces maintenance. Indicating light to show operating functions. Panel mounted high frequency assembly for ease of adjustment and maintenance.

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THE MID-STATES *Viking* AC/DC

SINGLE PHASE ARC WELDER

Patented movable shunt dual coil transformer provides stepless current adjustment. SILICON Rectifier may be factory installed or field installation may be made at a later date. Full 75 volt open circuit starts arc instantly with all types of electrodes. Sturdy all weather baked enamel case. Smooth stable arc over entire range. Skid mounted — three wheel truck available.

200-300-400 Amp
60% Duty Cycle

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MID-STATES WELDER MFG. CO.

6025 South Ashland Ave. Chicago 36, Ill.

away to provide a loose fit around the pipe.

Different shells were used for each 12-, 10-, 8-, and 6-in. pipe required in different parts of the network. The two halves were lined with firebrick, and the upper half of each furnace fitted with a burner, set approximately tangentially to the inner surface of the firebrick lining.

With the gas-air mixture set so there was an excess of gas over the air required for complete combustion—to prevent any possible oxidation of the steel pipe—the furnace was fired.

Temperature within the furnace was regulated so as to bring the weld area up to a temperature of 1,200F within 2½ hours. The temperature was maintained constant for 1½ hours, then dropped to 600F for 1½ hours.

After the weld had been heated according to the pre-arranged cycle, the furnace was removed. Then, after temperatures had dropped still further, the lower half was removed and the insulating material wrapped around the weld and held in place with a wire or steel band until the weld area had regained the temperature of the remainder of the pipe length.

Fit of the furnace shell around the pipe was such that the narrow annulus between pipe and shell served as exhaust for combustion products.

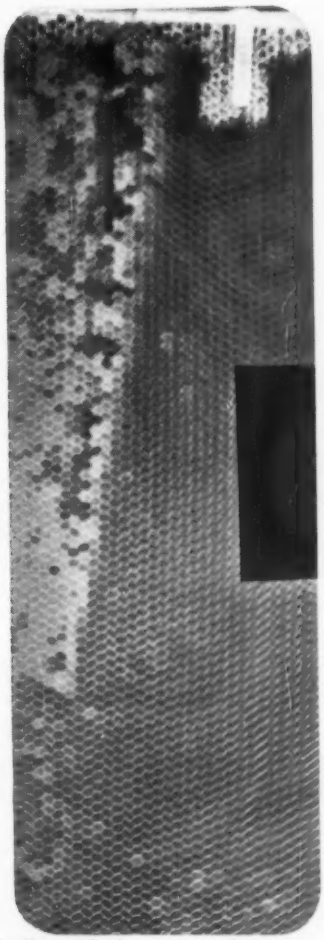
In the double-jointing yard, where it was possible to rotate the abutting length of pipe, submerged-arc welding was employed. These welds were immediately transferred to the curing yards. There the muffle furnaces were placed and the stress-relieving carried out as outlined for the treatment of field or over-the-ditch welding.

From starting the preheat to the final return to normal outdoor temperature, the fabrication required approximately 12 hours per weld. With a field length of 13.5 miles, and width half that, the amount of pipe required to tie 85 input and discharge wells to the system was enough to require almost six months for completion of the pipe laying.

Technician of New York Testing Laboratories places Kodak Industrial X-ray Film, Type AA, in position.

Keeping tab on trim tabs

Rigid inspection of American Airlines' jets includes radiography of trim tabs to reveal any accumulation of water from condensation.



Radiograph shows area where condensate is entrapped in honeycomb.

At the altitude and speeds which jet aircraft fly, temperature changes are frequent. This often means condensation—sometimes water accumulation in the honeycomb construction of the trim tabs.

This is something American Airlines keeps track of in its periodic rigid inspections. Best way is by radiography. And New York Testing Laboratories was one company given the assignment.

With a mobile X-ray unit, and using Kodak Industrial X-ray Film, Type AA, the inspection is made quickly and a lasting record obtained.

In such inspections of assemblies, in quality control, nondestructive testing, radiography provides a means of determining internal conditions.

Producers of castings and makers of welded products find radiography a means of expanding their business and making sure only quality work is delivered to the customer.

Would you like to learn how radiography could help you? Contact your Kodak X-ray dealer or write us for a Kodak Technical Representative to call.

Read what Kodak Industrial X-ray Film, Type AA, does for you:

- Speeds up radiographic examinations.
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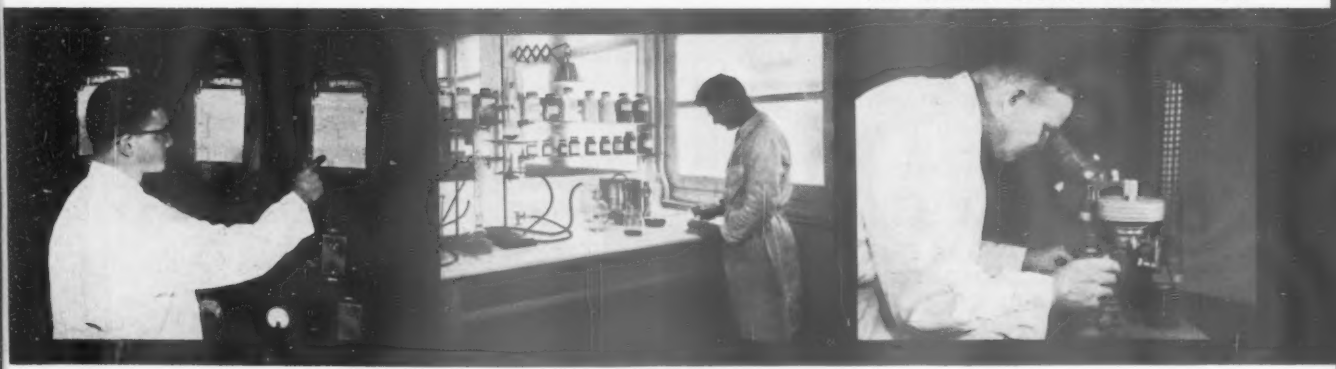


World Headquarters
Flushing, New York

MATTER OF CHANCE

Real progress doesn't "just happen". It must be carefully and deliberately *created!* It requires dedication and a relentless desire to make things better than they are.

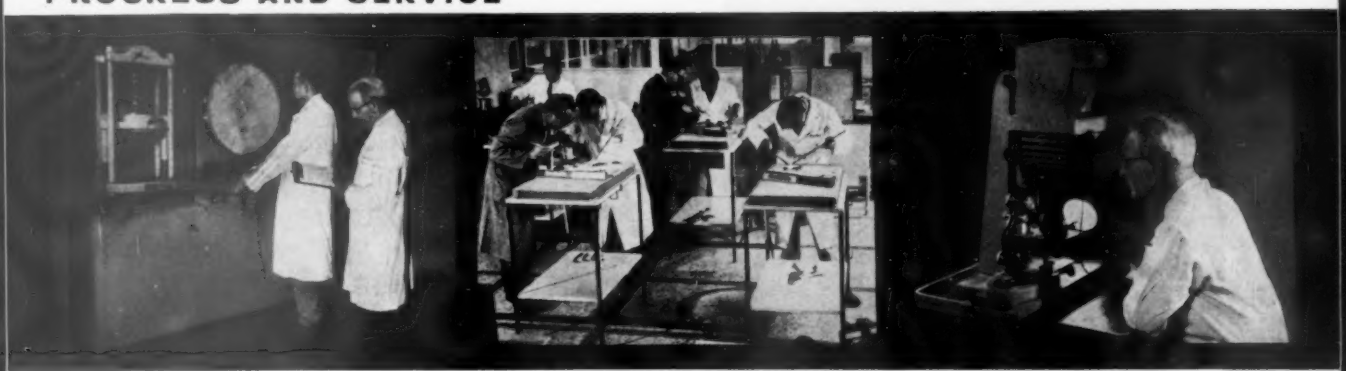
Ceaseless research has been the key to EUTECTIC progress since its inception 20 years ago. It began with the discovery of the "Surface Alloying" principle and the development of the exclusive Low Heat Input Welding Process – and has continued through the development of the more than 160 EUTECTIC "Low Temperature Welding Alloys"®, Fluxes and Welding Aids. The purpose has always been the same: to develop better methods of providing faster, easier and stronger welds... *while minimizing stresses, embrittlement, distortion and warpage created by conventional high heat methods.*

Today, these efforts are still going on – more than ever before! Every year finds new plants... new laboratories... new equipment being added to our already extensive facilities throughout the world. Soon, a vast new Foundry and Metallurgical Center will be completed – heralding the start of the most ambitious research and development program ever undertaken by this or any other company in the field.

Progress, based on research, is the primary aim at EUTECTIC. And progress *to us* means better products, improved techniques, and greater service *for you.*

NEW FOUNDRY AND METALLURGICAL DIVISION being constructed will house complete facilities for metallurgical research and developments, as well as the actual production of core wires from virgin metal.

PROGRESS AND SERVICE



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Aluminum piping Mig, Tig welded for natural gas distribution

ALUMINUM HAS INVADED many areas previously the exclusive province of steel. One of the latest: pipelines for transporting natural gas.

Two recent installations — one a field test — in Louisiana mark this latest threat to steel's dominance, although admittedly these were short, small-diameter pipelines.

Why aluminum?

Proponents of the lightweight alloy claim aluminum's primary advantages in a gas line system are corrosion resistance, increased gas flow because of smooth interior surfaces, and reduction in weight with no loss of strength.

In addition, they maintain that the higher cost of aluminum is considerably offset by its lighter weight, ease of handling and elimination of maintenance painting.

Most important of all, aluminum has the advantage of being a nonsparking material.

In one such installation at Baton Rouge, more than 1,600 ft. of seamless aluminum pipe serves Kaiser Aluminum & Chemical Corp.'s local alumina plant.

This above-ground line, with pipe diameters ranging from 4 to 14 in., is designed to deliver 50 million cu. ft. of natural gas daily.

MOTOR crane with single rope load-sling lifts 30-ft. fabricated section of 10-in.-diameter aluminum pipe. Line is designed to deliver 50 million cu ft of natural gas daily.

The buried steel pipe which formerly served the plant had been exposed during excavation and revealed severe corrosion. In designing the new aluminum line, it was decided to construct it above-ground because of the presence of complex underground installations and major plant streets.

Standard weight, seamless pipe was installed throughout. The 4 and 10-in. pipe are schedule 40, while the 12 and 14-in. sizes have a wall thickness of 0.375 in. Welding fittings and flanges, as well as all low and high pressure pipe, were made from 6061-T6 aluminum alloy.

In fabricating the line, the contractor, H. E. Wiese, Inc., used both Tig and Mig welding. Tig welding was done using a-c current with a bare 3/16-in.-diameter A-5356 filler rod. Mig welding used d-c current with 3/64-in.-diameter A-5356 aluminum wire.

The inert-gas shield was 99.995% pure argon with flow

"Baltospot is lightweight—the only completely portable 140-kv unit on the market. Ideal for inaccessible places."

E. E. Ellis says, "There's nothing to it. This unit will radiograph steel up to 1¾ inches thick."

"In less than a day I could teach anyone to make good inspection X-rays with BALTOSPOT,"

E. E. Ellis

says E. E. Ellis, Welding Engineer and Radiographer, Fisher Tank Company, Chester, Pennsylvania. "One year of experience with Baltospot X-ray equipment proved to us that practically anyone can make good radiographs. There are just three simple steps:

1. measure thickness of part and refer to chart
2. make exposure
3. develop film according to chart

X-ray inspection keeps us on our toes and is far ahead of other methods."

J. B. Fisher

Does Baltospot Pay?

"It certainly does," says J. B. Fisher, President, Fisher Tank Company. "We exercise better control over all phases of work, and save approximately 77 percent in radiography costs. Helping our welders maintain uniform high quality and developing new welding techniques are prime functions of this, the most effective means of testing welds."

Your Westinghouse X-ray Specialist has information on the full line of industrial radiographic-fluoroscopic equipment, or write: Westinghouse X-ray Department, 2519 Wilkens Avenue, Baltimore 3, Maryland. J-08369

YOU CAN BE SURE...IF IT'S

Westinghouse

WELDOR joins forged aluminum fittings to 4-in. extruded aluminum pipe using Tig welding method. Low pressure distribution lines were air-tested at 100 psi for two hours.

MIG welding was used to join the 10-in.-diameter aluminum pipe using 3/64-in.-diameter aluminum wire. High pressure portion of line was hydrostatically tested at 750 psi.

rates varying from 30 to 70 cu. ft. per hour for Mig welding and 18 to 40 cu. ft. per hour for Tig welding.

Although faster than the Tig process, Mig welding was more awkward to handle in close quarters because of its bulkiness. Thus, Mig was used on shop welds and readily accessible field locations, while Tig was used on all other welds.

Weldors were trained and qualified in both welding methods, and since the high pressure portion of the system was designed for 500 psi working pressure, specifications required all weldors to be qualified in accordance with the AWS Boiler and Pressure Vessel Code.

On completion of the installation, the 10-in.-diameter high pressure line was hydrostatically tested to 750 psi for two hours. Low pressure distribution lines were air-tested at 100 psi for the same length of time.

One major problem encountered during welding was porosity. Leaking "O" rings and a cracked porcelain cylinder in the Mig welding gun were allowing water to leak into the gas shield, causing hydrogen to be introduced into the weld.

Equipment repairs and slight modifications (*e.g.*, changing the ½-in.-diameter metallic nozzle to ⅝-in. diameter) improved gas flow and allowed better argon shielding of the arc and weld puddle.

Prior to welding, as well as between passes during actual welding, all joints were cleaned with a stainless steel wire-brush. Other precautions included keeping the Mig nozzle scraped clean of weld spatter, chipping or grinding all starts and stops to a taper before starting the next weld, and cutting ¼ to ⅛ in. from the filler wire before starting a weld.

The second aluminum pipeline installation, a mile-long test section, links a Louisiana well with Columbia Gulf Transmission Co.'s extensive gathering system.

Gas moving through the main 841-mile pipeline is ultimately distributed to nearly 1.5 million users in Ohio, Pennsylvania, West Virginia, Virginia, Kentucky, Maryland and New York.

The 6-in.-diameter aluminum field test line is 6061-T6 aluminum produced by Aluminum Co. of America.

Two test-sections, each 8-ft long with flanged ends, are used in the line. They will be alternated

WORKER holds 3-ft. section of 10-in. pipe which weighs 42 lb in aluminum compared to 120 lb in steel.

DUAL metering system of plant shows tie-in of aluminum pipe (left) to steel pipe at insulated flange.

Lewis Welding & Engineering Company of Bedford, Ohio, welded this annulus for Clark Bros. Co. of Olean, New York, producers of industrial gas turbine engines.

Here's a dissimilar alloy weld that's reliable above 1000° F...

When this liner for an industrial gas turbine annulus is hooked up to a combustion chamber, it will face temperatures over 1000°F. That's how hot its metal surfaces get when they channel high temperature combustion gases toward whirling turbine blades.

The welding of these dissimilar alloy parts, one heavy, the other light, becomes really important when operating conditions are considered. Shutdowns are rare in industrial gas turbine service, and welds must last for years. But the Inco-Weld* "A" Electrodes used here eliminate the possibility of weld failure.

No heat problems

That's because the Inco-Weld "A" deposit is both ductile and strong. In all likely combinations, it is compatible with high-temperature-type base metals.

Inco-Weld "A" Electrode, remarkable for its ability to weld 97% of all dissimilar alloy combinations, is *equally remarkable* for its ability to provide dissimilar alloy joints capable of long-term resistance to heat and corrosion.

Operability is excellent

With Inco-Weld "A" Electrode it's easy to produce ductile X-ray quality welds. You can weld in all positions, the arc is spray-type, slag removal is good, and spatter is at a minimum.

Inco-Weld "A" Electrode is supplied in 3/32, 1/8, 5/32 and 3/16 inch diameters, packed in 5-lb sealed asphalt-lined containers for convenience and protection.

Plan to use Inco-Weld "A" Electrode the next time you weld dissimilar alloys. For information on the weld properties you can expect, write for our 6-page brochure, "Now You Can Weld 97% of All Dissimilar Alloy Combinations with One Electrode."

*Inco trademark

Combustion chamber liner is made of Inconel* nickel-chromium alloy and other high temperature alloys, production welded with Inco-Weld "A" Electrodes.

HUNTINGTON ALLOY PRODUCTS DIVISION

The International Nickel Company, Inc.
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INCO TRADE MARK WELDING PRODUCTS

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PIPE and wire are aligned prior to Mig welding 6-in.-diameter sections for Louisiana test gas line.

WHEN joint is completed, aluminum pipe was pulled through welder so next joint could be aligned and welded.

CAPPED pipe is lowered into flooded trench and then floated into position as joints are completed.

in service to permit regular and thorough inspections of the unwrapped, uncoated pipeline.

This is part of the gas company's evaluation of aluminum pipe's performance for possible expanded use in gas transmission lines.

The aluminum pipe, called Unistrength, is a seamless, tubular product with thicker walls at the pipe ends than along the length. The greater thickness, according to Alcoa, compensates for strength reductions caused by welding heat.

The pipe's nominal wall thickness at the ends was 0.432 in. Thickness elsewhere in the pipe was 0.272. This variation cut costs by 20% compared to aluminum lines previously installed.

Welding was done with both manual Tig equipment and Alcoa's automatic Mig pipe welder. As the line was laid, advantage was taken of the region's being close to sea level, which caused the trench to flood.

The leading end of the pipeline's first section was capped. After each joint was completed, the pipe was pulled manually through the welding machine, lowered into the flooded trench, and then floated into position.

When the final section had been joined, the line was hydrostatically tested at a pressure of 1,250 psi. Prior to back-filling, marsh weights were installed to anchor the line securely. The aluminum pipeline is now moving gas at a pressure of 1,000 psi.

"Your pay envelope will be a little heavier, Emerson; I'm putting a pay check in it this time!"

This way to quality...

Plan to visit our Booth 207, at the forthcoming AMERICAN WELDING SOCIETY'S 41st Annual Convention and Welding Exposition being held at the GREAT WESTERN EXHIBIT CENTER, Los Angeles, California—April 26 to 28—where you will see the many NEW items of our manufacture. One of the most versatile operators of the welding torch will be on hand to demonstrate his amazing artistry in hand cutting . . . a special section will be devoted to the demonstration of the latest in oxygen therapy equipment . . . and an experienced glass blower will put some of our air-gas apparatus through its paces. Many other programs of interest are scheduled for this contact booth, so come see us . . .

We look forward to greeting old friends . . . and hope to meet many new ones.

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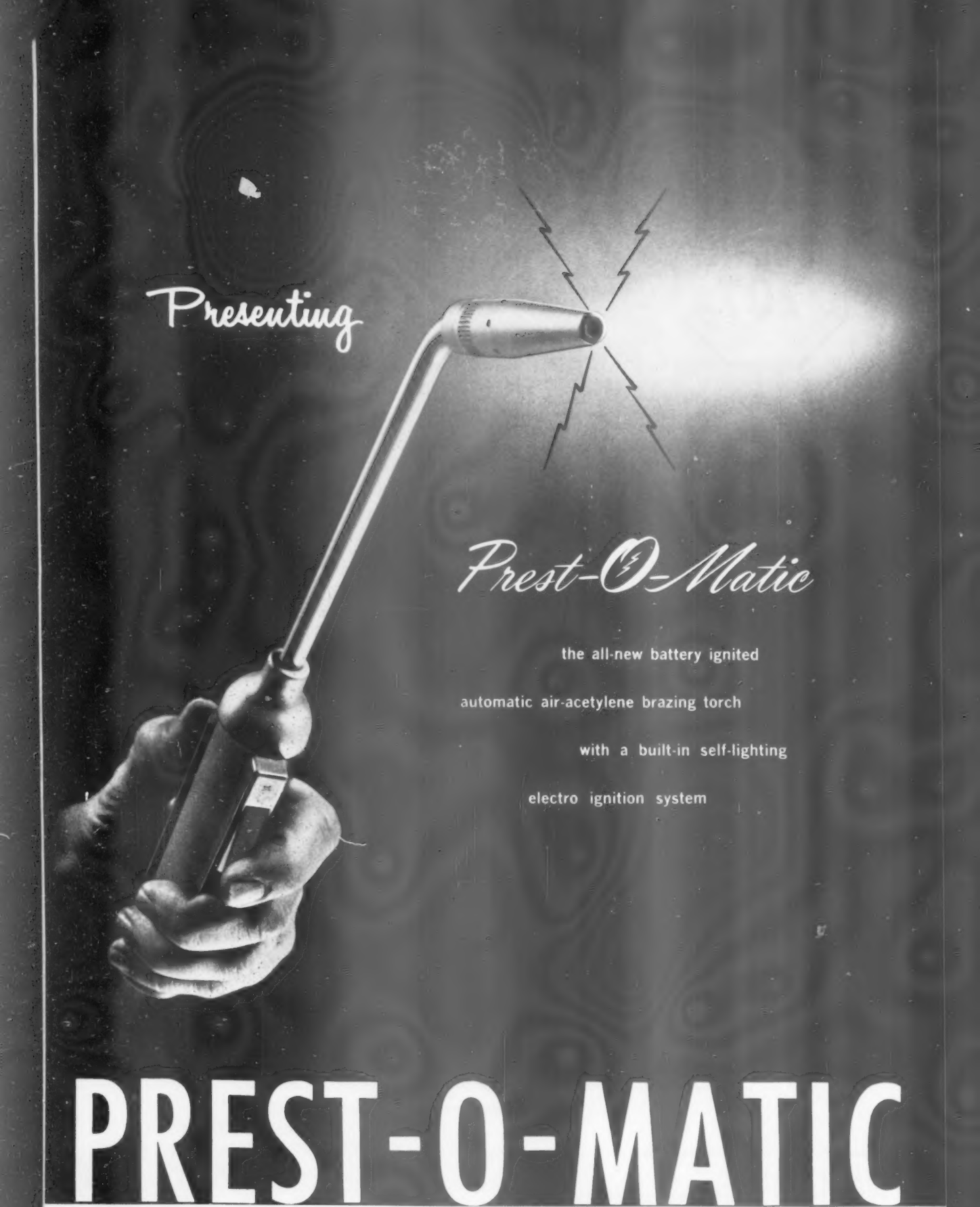
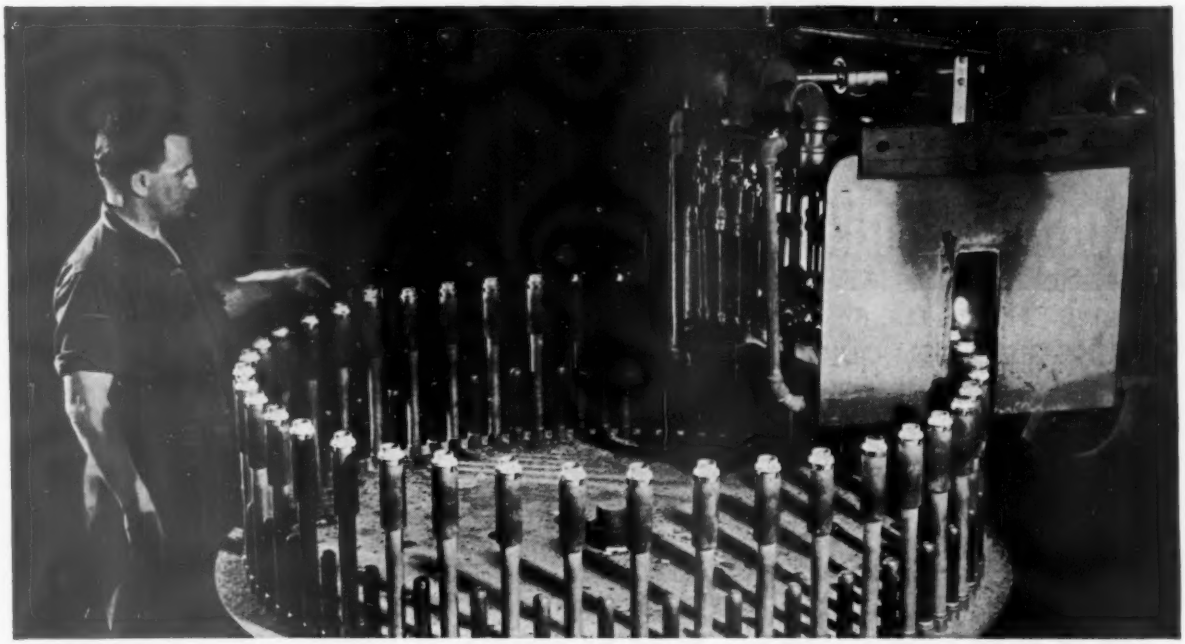


PREST-O-MATIC

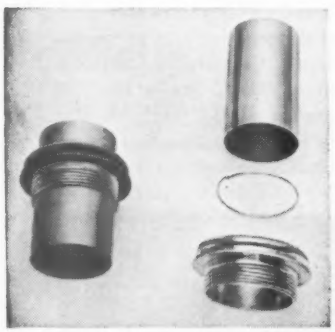
Visit our booth Number 701 at the
National Welding Show, April 26, 27, 28 . . .
Great Western Exhibit Center/Los Angeles, Calif.

PRESTO-O-MATIC CO., INC. POST OFFICE BOX 531 • COSTA MESA • CALIFORNIA

Every Hour M. S. Little Brass Goods Company Makes 650 Appliance Fittings Better With HANDY & HARMAN SILVER BRAZING



Rotating jig showing mounted assemblies entering and leaving gas-air furnace.



Left– brazed assembly. Right– components with preform ring of EASY-FLO *45.*

This Hartford, Connecticut, company makes—in volume—an assembly that goes into the overflow system of household appliances. The assembly consists of brass tubing and a machined brass casting. The two components are joined by a preplaced ring of Handy & Harman EASY-FLO 45 silver brazing alloy and HANDY FLUX. Heating is automatic gas-air; parts are placed on a rotating turntable to pass through the gas furnace. Every 60 working minutes, 650 assemblies are completed.

The advantages here are that the manufacturer can use thin-walled tubing with heavier, threaded components at no sacrifice in strength. Because of EASY-FLO's penetrating qualities, the entire shear area is fully as strong as the solid parts of the assembly, yet considerably lighter. And, casting and machining the components for this assembly have been greatly simplified.

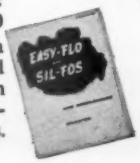
Are you in pursuit of a metal-joining method which offers—among other advantages—high, uninterrupted production at low capital investment? You may easily find the answer in Handy & Harman silver brazing. Hundreds of manufacturers and fabricators of as many different products, parts and components are right now enjoying the speed, economy, strength and *flawlessness* of brazing. You can too. Just ask Handy & Harman, 82 Fulton Street, New York 38, N. Y.

COMING IN NOVEMBER!

New Handy & Harman Brazing Correspondence Course. Simple self-study data on all phases of brazing. Send for details to Dept. BC.

FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits . . . includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



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Write for FREE booklet "Reducing Costs By Proper Care Of Arc-Welding Circuits"

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Brown heads iron group

JOHN W. BROWN was elected president of the National Ornamental Iron Manufacturers Association at its recent convention in New Orleans.

Other officers elected were: R. W. Colver, first vice president;

ENGAGED in technical discussion are, from left, Vernon Stiles, Arthur H. Jones, John L. Lanciloti, and Frank Kozik.

Vernon McFarland, second vice president; Jim Kathman, treasurer; and Melvin Peterson, secretary. Chosen as directors were: Howard Troxler, John L. Lanciloti, Howard Wilson, and Otis Schmidt.

An ornamental iron academy and a trade exhibit were part of the convention. Eight West German ornamental iron fabricators attended through auspices of the International Cooperation Administration.

Birmingham, Ala. was picked as the site for the organization's 1961 convention.

CHOSEN Miss Ornamental Iron of 1960 is Bonnie Young, 19, of Baton Rouge, La.

TEC PRESENTS AN UNBEATABLE FORMULA FOR TOP TIG WELDING!

TEC Visuweld Watercooled Torch

The standard bearer of the quality TEC Torch line proven by scores of satisfied users throughout the country.

Lightweight, and maneuverable, the TEC water-cooled operates from 3 to 350 Amps with maintenance free efficiency because of one-piece torch head design which eliminates troublesome wearing or leaking.

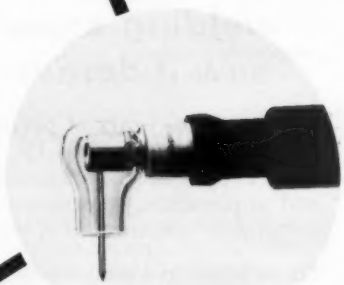
Exclusive "tip-of-torch" water cooling affords continuous welding even at 350 Amps. No finer welding instrument on the market.

FEATURING
TEC Visuweld Vycor* Transparent Gas Nozzles*

TEC Air-cooled Torch

This smooth operating newcomer to the TEC line is gaining plaudits for its great gas savings and its effortless performance.

Rugged and durable due to one piece construction of phenolic plastic reinforced with macerated fiber glass, the TEC Air-Cooled utilizes both standard and off-set Visuweld transparent nozzles.



TEC Spot Gun

Here's the one spot gun that has been engineered not to create problems, but to solve the production gap between resistant welding and arc welding.

Lightweight, "tip-of-torch" cooled, and trouble-free the TEC Spot Gun enables welding all gauge thickness joints from only one side efficiently and economically.

TEC "Tiny Giant" (Pencil) Torch with Off-set Nozzle)

Only the magic of TEC ingenuity could have developed so simple, yet revolutionary an innovation.

TEC's off-set nozzles and chucks convert the TEC watercooled and air-cooled torches into miniature torches which enable TEC TIG welding in less than 1½ inches of space!

You always have the winning formula when you specify TEC for your TIG welding requirements. Dedicated to producing the finest possible equipment in the industry, TEC products have proven time and time again that they out-perform all others . . . that tig welding can be more economical, maintenance free, and can produce results never before achieved. See your nearest TEC distributor today or contact TEC directly for personal service.

BOOTH #619 APRIL 26-27-28 GD
GREAT WESTERN EXHIBIT CENTER Los Angeles, Calif.
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TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. Manufacturers of Visuweld Equipment

"Yes, the De Witt System of Joint Preparation is Worth Investigating"

said **13** prominent pipe manufacturers and welding experts who saw it demonstrated

More than 20 years of preparation were required to develop the De Witt System of Joint Preparation. Revolutionary in concept and application, it prepares joints in ANY metal with a minimum of work and expense.

Those who have seen the system in operation are amazed at the ease and speed with which you can switch pipes, thickness of walls or angle of intersection without the use of dies or expensive milling equipment.

The De Witt System uses carbide tooth saws or Wallace safety type abrasive wheels and is the outgrowth of Wallace "Cut-Machining", the low cost process used throughout the metal working industry.

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Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Design for welding

Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability

Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

Tungsten inert gas

A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals

Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene

A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing

Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. This reprint is free.

Selection, welding of CrMo alloy steel pipe

Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

How to select proper regulators

Performance characteristics of equipment controlling gas flows during welding, cutting and other operations are given, as well as selection rules.

Filler metals for joining

Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls

Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture

Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed.

Explosive welding and forming open another door

A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

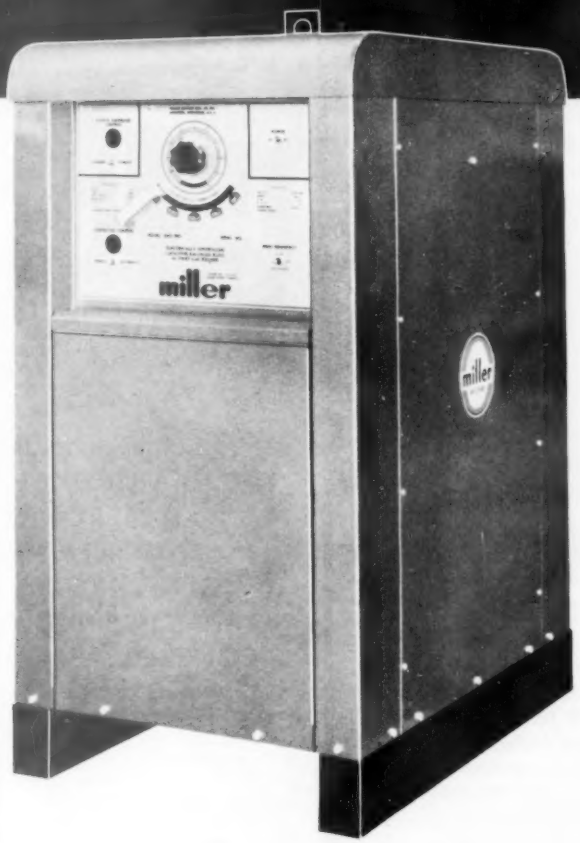
Our modern-day mythology

A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage

Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.

NEW BALANCED WAVE TIG WELDER DELIVERS DEEP, CLEAN "X-RAY" WELDS ON SHEET METAL or PLATE



- A bold new concept in electrical design and circuitry is introduced in the all-new Miller BWC-300MAP. One of several notable results is complete and automatic elimination of the d-c component at all welding currents . . . an essential in certain critical welding applications.
- Due to the specially designed transformer, high arc initiation voltage and unique circuit, arc-outages cannot occur.
- "Fail-safe" voltage reducer automatically lowers the high arc initiation voltage to a low open circuit voltage – even in case of malfunction of the reducer.
- The original Miller Electrical Control provides simple, safe and precise control of the welding current at the machine or from a remote control station.
- Five independent welding ranges with overlap offer an infinite number of positive, fine current settings – another characteristic of Miller's electrical control that speeds up and simplifies critical welding jobs.
- Optional equipment includes: Remote hand and/or foot controls; 10 or 40 gallon water coolant systems; running gear which carries welder with coolant system and gas cylinders.

EXCLUSIVES! — found only in new Miller BWC-300MAP:

1. **Perfect balance throughout the entire welding range EVEN DURING CRATER ELIMINATION.**
2. **Arc stability WITHOUT HIGH FREQUENCY at as low as 18 amperes.**

The outstanding versatility of this welder, and the specifics on its various features, are detailed fully on our form #BW-3 — a copy of which will be sent to you promptly upon request.

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Ultrasonic Flaw Detection now Ultra-Practical in every shop!

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pulse-echo type instrument

combines the highest performance yet achieved with the smallest size, weight and price in the field. It is equally at home in contact and immersed work.

Every metalworking shop can now afford quick, accurate, inexpensive tests on internal structure of Bar Stock, Strip, Plate, Castings, Weldments, Brazed Assemblies, Machinery Shafts, etc.

SONORAY® Ultrasonic Flaw Detector testing aluminum bar stock; easily probes the full 12-foot length as well as through thickness.

SONORAY® Model 5 clearly resolves 3/64" FBH at 3/16" in contact at 2.25 mc/s — reveals 1/64" FBH full-scale at 2.25 and 5.0 mc/s — brings laboratory precision into the field with simplified controls, a weight of only 37 pounds and a price of . . . . . $2750.

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Induction equipment speeds gear annealing

A MAJOR AUTOMOBILE manufacturer recently installed a semi-automatic induction heating machine which anneals both ends of a gear shaft at the rate of 740 pieces per hour.

The machine, designed and built by Induction Heating Corp., Brooklyn N.Y., draws or tempers both the threaded and slotted ends of the shaft simultaneously.

It consists of a 50 kw, 10,000 cycle totally enclosed water-cooled motor generator, its master control and work station, cabinet and semi-automatic tooling.

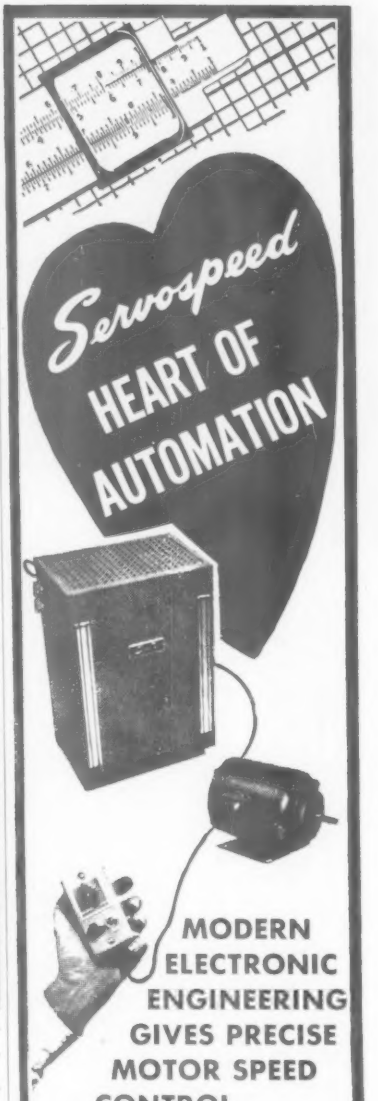
Steel rollers rotate the shafts during the heat cycle to insure perfectly uniform results. As the parts

INDUCTION heating equipment can anneal pieces at rate of 740 per hour.

rotate and travel around, they enter the work coil heating zone. This consists of two semi-circular inductors in parallel, with special water cooled shorting stubs fastened to the larger rear inductor.

In this way, the threaded end is drawn to a hardness of Rockwell C 32 and the slotted end to that of Rockwell C 50, to reduce any tendency to break under shock. The entire part is carburized and hardened to give good metallurgical characteristics.

The parts are manually loaded at the front center position with the threaded end pushed up against the adjustable stop rail. This method is said to result in considerable savings over the former system of lead pot annealing, or selective copper plating the ends before carburizing.

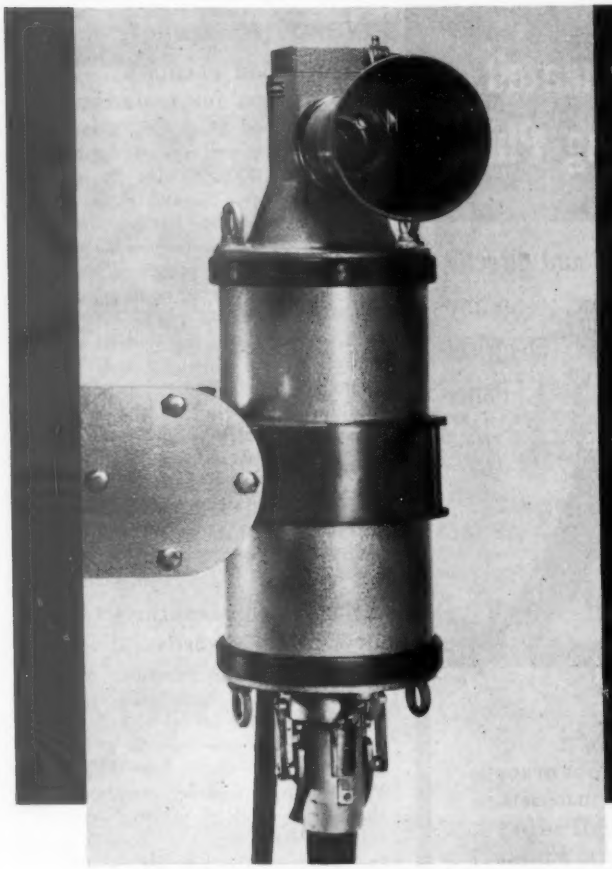


MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J
ARmory 4-8989



"FEATHER TOUCH"

X-RAYS WITH THE NEW NORELCO TWIN FOCUS

0.7 MM & 2.5 MM

BERYLLIUM WINDOW TUBE

Another addition to the most extensive line of industrial X-ray equipment available – NORELCO – this versatile new tube extends the kilovoltage range down to 17 KV without sacrifice of the higher ranges up to 150 KV.

Long wavelength or "soft" X-rays necessary for optimum contrast and visualization of light elements and alloys so essential to many segments of industry has long been hampered by two factors:

1. Conventional industrial X-ray tubes do not permit X-ray production under 30 KV because of the relatively high inherent filtration of the tube window.
2. Most available beryllium window tubes are basically designed for X-ray diffraction or irradiation techniques and are therefore ill-fitted for precision radiography. These tubes usually have a focal spot size in excess of five millimeters and are therefore unable to resolve minute flaws.

The new Norelco 0.7 mm. and 2.5 mm. fractional focus beryllium window tube completely eliminates the foregoing conditions. Used in conjunction with the MG 150, which provides a *constant potential source* of X-rays from 17 to 150KV, this new tube will produce a range of amazingly sharp radiographic images of objects with light or minimal opacity, extending into heavier metal sections.

Inspection with a Norelco Industrial Image Intensifier and this new beryllium tube has revealed flaws and discontinuities in thin light sections which could not be demonstrated by competitive equipment.

We stand ready to give proof! Call or write to arrange for an actual demonstration of this equipment—*on your samples.*

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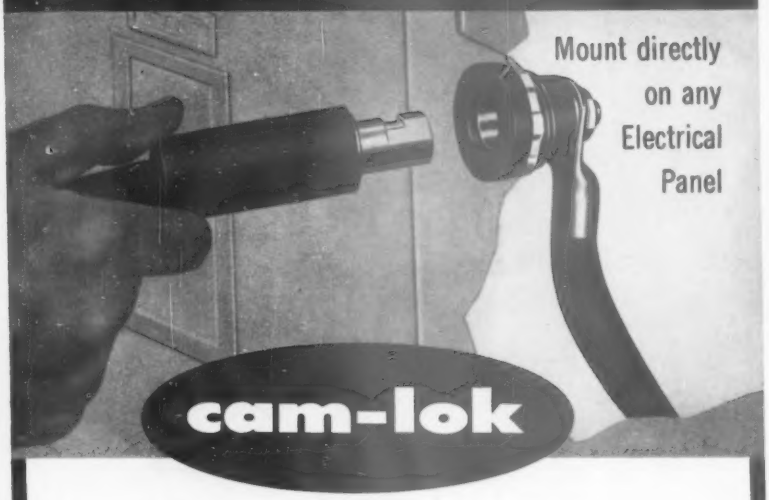
New Hi-Impact Plastic Insulated Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast direct mounting on . . .

- **ELECTRICAL DISTRIBUTION PANELS**
- **SWITCHGEAR**
- **BUS DUCT**
- **JUNCTION BOXES**
- **WIREWAY or any electrical cubicle**

Visit the Cam-Lok Booth #403 at the Los Angeles Welding Show, April 26-28

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EMPIRE PRODUCTS, INC.
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Cincinnati 36, Ohio

News... from p. 8

Alan Wood earmarks $36 million for expansion

Alan Wood Steel Co., Conshohocken, Pa., will spend approximately $36,000,000 over the next two years on a capital expansion plan. The expansion has been made possible by completion of a $30,000,000 financing program, and is the first step in a contemplated ten-year expansion plan.

The funds will be used to construct a new blooming mill and plate mill, to be located in a new building adjacent to the firm's existing hot strip mill.

The new blooming mill will be capable of rolling slabs up to 54-in. wide, while the plate mill will be able to roll plates up to 96-in. wide and 4-in. thick.

ASM establishes three new metal awards

Trustees of the American Society for Metals have established three new ASM Metal awards.

Two of the new awards will be given in honor of the late William H. Eisenman, founder member of the Society and its national secretary for 40 years. The third is in the name of the late Dr. Marcus A. Grossman, past president of the organization.

The Eisenman awards will be for outstanding contributions in the practical application of metallurgy to metal production or engineering; and for outstanding teaching of metallurgy or related sciences.

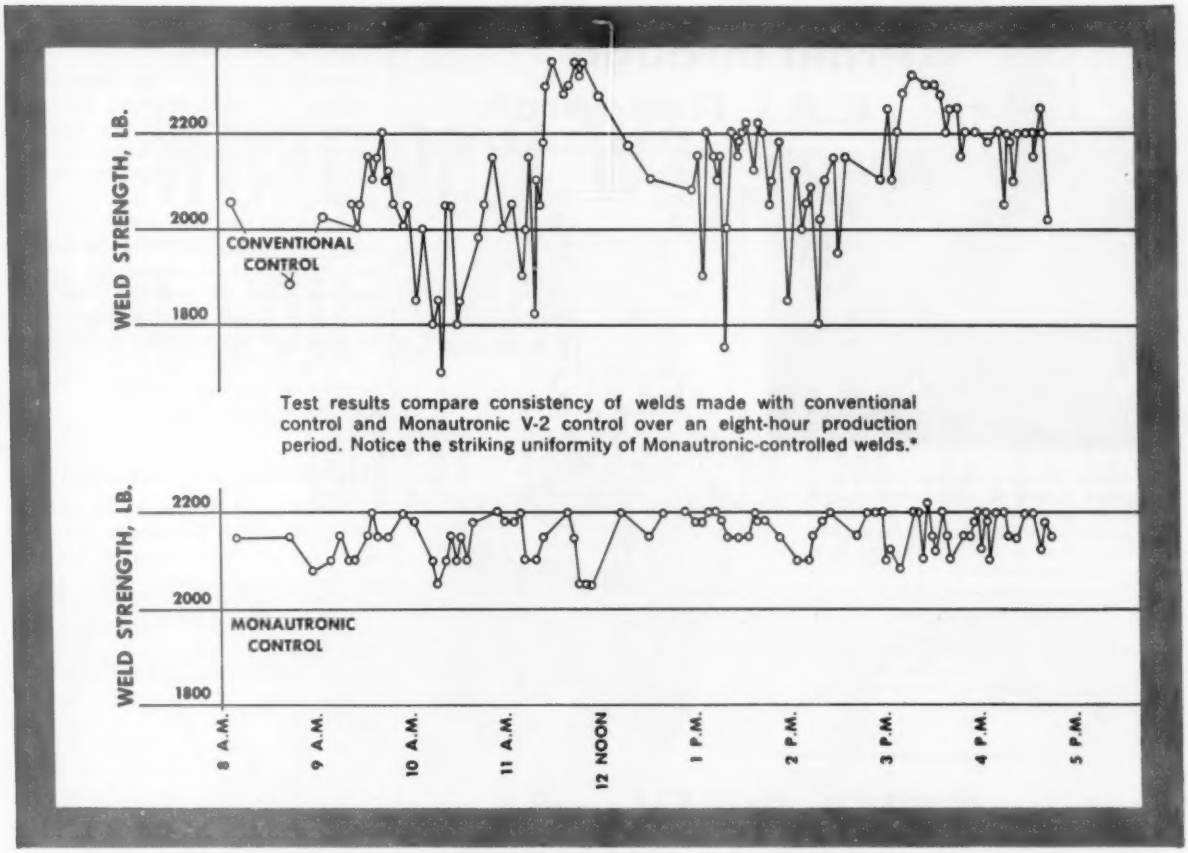
The Grossman award will encourage creative writing by young metal scientists.

Summer welding course to be held at Ohio State

Sponsored by Ohio State University, a summer conference course on fundamental principles of welding engineering will be held June 13 through 24 at the campus in Columbus.

Course content will not be restricted to any particular type of welding fabrication but is intended to provide training applicable to many fields. Interrelationships of the welding process, product design, production techniques, and quality control will be emphasized.

The course will be supervised and presented by members of the faculty of the university's department of welding engineering.



Test results compare consistency of welds made with conventional control and Monautronic V-2 control over an eight-hour production period. Notice the striking uniformity of Monautronic-controlled welds.*

new feedback control gives you consistently high quality welds . . . automatically

Monautronic V-2 welding control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

The new *Monautronic V-2* welding control makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The control compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures uniform production of high quality welds.

Any metal that can be resistance welded can be welded better with the Monautronic V-2 than with any other control on the market.

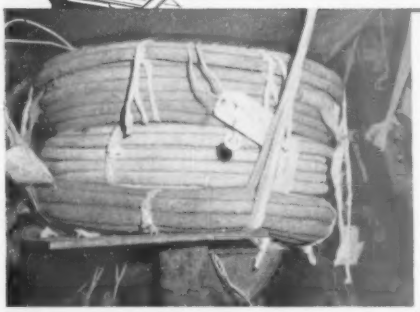
For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

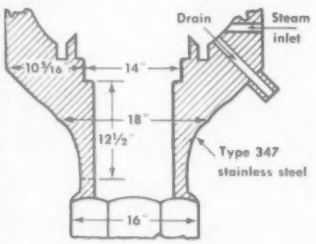
*Case study upon request.

2450 Hunting Park Ave. Philadelphia 32, Pa. ▪ 12141 Charlevoix Ave. Detroit 14, Mich. ▪ 3050 East 11th St. Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

Profit through E.A.I. Research





Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.

SMITH-DOLAN On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

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ELECTRIC-ARC

Good attendance at AIRPS regional meeting

Attendance at the first regional meeting of the Associated Independent Rebuilders & Parts Suppliers was more than double that expected, the organization reported.

The meetings, held during February in Atlanta, featured discussion sessions and workshops on subjects such as protecting suppliers from wrong claims, discounting bills, and balancing inventories.

Dallas will be the site of the next scheduled regional meeting, to take place April 8-9.

Distributor Appointments

United Specialties, Inc., El Dorado, Ark: Riley Enterprises, Mobile; James Engineering & Machinery Co., Dearborn, Mich.

Wallace Supplies Mfg. Co., Chicago: Allied North West Machine Tool Corp., Portland, Ore.; Cleveland Duplex Machinery, Lakewood, Ohio; Harley-Pence Machinery Co., Los Angeles; Lakeshore Machinery & Supply Co., Muskegon, Mich.; Edward A. Lynch Machinery Co., Wynnewood, Pa.; Machinery Sales Co., Los Angeles; Leonard R. Nourie, Inc., Pittsburgh; Perine Machinery & Supply Co., Seattle; M. M. Thackaberry, Inc., Los Angeles; Foulis Engineering Sales, Ltd., Halifax, N. S.; William Orlick, Ltd. Hamilton, Ont.; Alexander & Orlick, Montreal.

American Platinum & Silver Div., Engelhard Industries, Inc., Newark: Austin-Hastings Co., Inc., Cambridge, Mass.

Upton Bradeen & James Ltd., Toronto: National Electric Welding Machines Co., Bay City, Mich.

Turn Tubes Division, Chemetron Corp., Louisville; Holliday Steel Warehouse Division, Jones & Laughlin Corp., Indianapolis; Epperson & Co., Tampa, Fla.; Columbus Iron Works Co., Columbus, Ga.; Crane & Ordway Co., St. Paul; Moore Dry Kiln Co., Jacksonville, Fla.; Production & Refining Equipment Co., Odessa, Texas; Master Supply Co., Joliet, Ill.

Wall Colmonoy Corp., Detroit: Winslow Electric Co., Chester, Conn.; Korb & Beale Associates, Cleveland.

Induction Heating Corp., Brooklyn: Denton & Anderson, Chicago.

Ampco Metal, Inc., Milwaukee: District Oxygen Co., Inc., Brentwood, Md.; Welding Supply & Specialty Co., St. Paul.

What new ways can you save with industrial gases ?

ask your Liquid Carbonic sales engineer...

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So many are the ways to use compressed gases . . . so rapidly do new techniques appear . . . how can you keep up with them all?

That's our job—a part of Liquid Carbonic service.

Through a continuing program of "What's New" seminars, Liquid Carbonic sales engineers learn all the recent developments at first hand: new applications of gaseous and liquid oxygen, liquid nitrogen, hydrogen, acetylene, CO_2, argon. Cost-cutting ideas for steelmaking, casting, cutting, fabricating, welding . . . all learned from the practical standpoint—all "learned by doing."

Discover the latest applications of industrial gases, using dynamic Liquidweld apparatus and precision Messer cutting machines.

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A MAJOR PRODUCER OF COMPRESSED GASES: OXYGEN, ACETYLENE, NITROGEN, HYDROGEN, ARGON, CARBON DIOXIDE, NITROUS OXIDE, HELIUM AND VARIOUS GAS MIXTURES

News Shorts . . .

Air Reduction Sales Co., New York City, is planning a multi-million dollar liquid air separation plant in Tampa, Fla. It will be the first such commercial plant in Florida. . . Memorial contributions received by the **American Society for Metals** following the death of William H. Eisenman in May, 1958, will be used to create a collection of rare and important books on metallurgy. . . **Air Reduction Pacific Co.**, another division of Air Reduction Co., New York City, recently dedicated a new liquid air separation facility in Richmond, Calif. . . . **Coated Abrasives, Inc.** has transferred its manufacturing and headquarters operations from Milwaukee to Detroit.

E. A. Hobart, Frank Smith, W. H. Hobart

Roy Smith Co., Detroit, has finished first among distributors of **Hobart Bros. Co.** Troy, Ohio, in 1959. The company was cited (see picture) for building sales in welding equipment, electrodes and accessories. . . First in Hobart's contest for percentage gain over quota was **Newkirk Sales Co.**, Waterloo, Iowa. . . **Aero Supply Mfg. Co., Inc.**, Corry, Pa., has acquired an interest in **International Ultrasonics, Inc.**, Rahway, N. J. Aero will assist in financing production of a new ultrasonic continuous seam welder for aluminum foil and other thin metals.

Superior Propane Ltd., Toronto, has purchased the carburetion division of **Bescom Corp.**, Montreal. . . **Foote Mineral Co.**, Philadelphia, has completed expansion of its electrolytic manganese facilities in Knoxville, Tenn., and authorized purchase of a 670-acre tract of land near New Johnsonville, Tenn. as a facility site.

Robotron Corp. Detroit, has opened a new subsidiary, **Robotron of Canada, Ltd.**, at Sandwich West, near Windsor, Ont. Robotron also will add 12,500 sq ft of plant space to its facilities in Detroit. . . A new, high-temperature alloy developed by **Stanford Research Institute** metallurgists is performing successfully at temperatures up to 1,750 F in jet engines. Known as WI-52, the alloy contains 13% tungsten and supplants the X-40 alloy in use since 1941.

A new technical organization – the **Fluid Power Society** – has been formed to further the development of that field, and to bring together persons engaged in a wide variety of fields utilizing fluid power. The group's first meeting will be held at the Statler Hilton in Detroit April 21. . . New tubular steel "sulky" for weldors on bridge girders and other overhead structures is designed to replace wooden float or platform slung on ropes (see photo). It was designed by the **P. H. Mallog Co.**, Niles, Mich.

Photo Courtesy Lincoln Electric Co.

The 36th X-ray school of **Norelco**, Philips Electronics Instruments, Mount Vernon, N. Y., will take place at the North Park Hotel, Chicago, from June 13 to 17. . . **Arcos Corp.**, Philadelphia, has moved its Los Angeles office to a new warehouse-sales office building at 6222 Chalet Drive, Bell Gardens. . . All welding and cutting outfits of the **Dockson Corp.**, Detroit, will be packaged in specially designed shipping-display cartons.

MISSILE AGE PAUL BUNYAN

LIFTS 80,000 POUNDS

WITH THE STRENGTH OF

ATOM·ARC 'T'

Hufford Corporation specified all-welded construction for maximum strength, minimum weight

Transporting 80,000 pound rocket engine units and erecting them on test stands requires equipment that is unusual both in design and strength properties. Hufford Division of the Siegler Corporation met this challenging project for Thiokol Chemical Corporation with this mobile handling unit called the Transrector.

The first requirement as a transporter necessitated the use of a minimum weight material for fabrication to reduce the overall hauling load. The use as an erector made strength a highly important factor. This high strength to low weight ratio was achieved through the exclusive use of T1 steel. To retain the inherent strength of T1, the design engineers specified all-welded construction.

Alloy Rods Company's ATOM·ARC "T" more than satisfied Hufford's needs. The only electrode designed specifically to weld T1 steel in all applications, ATOM·ARC "T" weld metal physical properties equal or exceed those of T1 steel in the "as welded" or "stress relieved" condition for 100% design joint efficiency. ATOM·ARC "T" electrodes are also excellent for many other applications where high strength welds are required.

Detailed application information about ATOM·ARC "T" in data sheet form is available by writing Alloy Rods Company, P. O. Box 1828, York 2, Pennsylvania.

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

SALES OFFICES AND WAREHOUSES

NEWARK • PITTSBURGH • PHILADELPHIA
BOSTON • CHICAGO • SAN FRANCISCO
EL SEGUNDO, CALIFORNIA
DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

Alloy Rods Company

LINCOLN HIGHWAY WEST
YORK, PENNSYLVANIA

About People . . .

Greenberg

Cusack

Simon A. Greenberg has been named director of engineering and training for Eutectic Welding Alloys Corp., Flushing, N. Y. He was technical secretary of the American Welding Society for 15 years before resigning several years ago.

George C. Cusack, recently elected president of the Compressed Gas Association, has been named president of Pure Carbonic Co., a division of Air Reduction Co., Inc., New York City. He succeeds *J. J. Lincoln, Jr.,* who has been transferred to the executive staff of the parent company.

Amel Meyer has joined Standard Oil Co., Indiana, Whiting, Ind., as senior welding research engineer and metallurgist. He was formerly director of welding research for Graver Tank & Mfg. Co., East Chicago, Ind.

Gordon E. Brown has been named sales manager of the Ampco Metal, Inc. West Coast Division and *George W. Pipp* has been appointed branch controller by the Milwaukee firm. The assignments encompass sales and financial management of the company's activities in 11 western states.

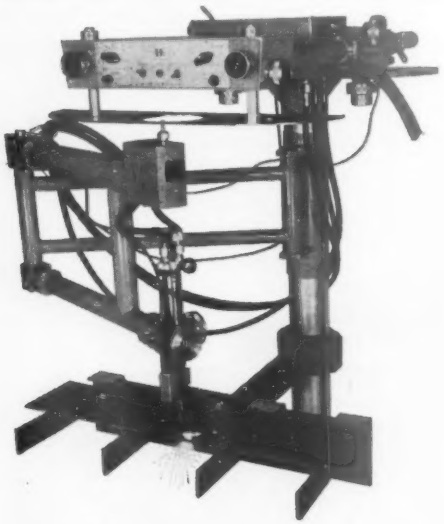
Vickers, Inc., has made two changes in personnel: *Frank Hynes* has been appointed as manager of military sales of the firm's Electric Products Division, St. Louis and *John F. Kramer* has been transferred from that division to the Washington, D. C. office.

Edwin S. Coyle has been promoted to manufacturing manager of the Electronic Controls Section of the Budd Co., Philadelphia. Coyle, whose new position will include total manufacturing responsibility for the section's Monautronic welding controls, will be headquartered at the company's Philadelphia plant.

J. A. Fox has been assigned to the Newark Sales Office of Alloy Rods Co., York, Pa., and *R. G. Rogers* has been named to the firm's San Francisco Bay area sales office at Emeryville, Calif. Both men underwent training in welding alloys and applications at the company's main office and plant.

Rogers

Fox



SERIES 460 ULTRA-GRAPH

A transistorized DC control system eliminates sudden and variable current fluctuations, insuring constant travel speeds critical to quality cutting or welding operation. A Series 460, 600, or 900 Ultra-Graph with automatic valve manifold and torch lighter provides top efficiency and convenience for economical flame cutting.

For information write for Bulletin 54. Also see your local welding supply distributor for a U-G demonstration.

Here's an example of flame cutting with a Heath Ultra-Graph

Often we find individuals manufacturing products of steel turn away from using flame cutting because they consider it primarily for large and rough surfaced work. But consider this small C-clamp which was flame cut from ½" x 3" mild steel by a Series 460 Ultra-Graph Guidance Machine. The piece is definitely not large, the edges are sharp and defined, and the cut surface is smooth and even. Using a forged clamp as the pattern, the Ultra-Graph produced this piece in about one minute. The clamp was wire-brushed lightly to remove the mill scale leaving a clean polished finish. The addition of a thumb screw completed this inexpensive flame cut clamp.

HEATH ENGINEERING COMPANY

168 AULT ROAD
FORT COLLINS, COLORADO

AROUND

General Cable's rubber-insulated welding cable is so flexible you can run it almost anywhere. It provides excellent resistance to abrasion, twisting, impact, heat, moisture and weather. Our neoprene-insulated welding cable extends this durability by also resisting flame and oil. And for really heavy-duty use, our Super Service welding cable combines unusually-fine strand construction with a heavy-duty, mold-cured neoprene insulation-jacket. This Super Service type complies fully with all of the applicable IPCEA standards. General Cable also manufactures a superior Welder Power Supply Cable to complement its regular line of welding cables. Call your authorized General Cable Distributor for full information.

GENERAL CABLE CORPORATION

730 Third Avenue, New York 17, N.Y. ■ Offices and Distributing Centers Coast-to-Coast

VALUE VERSATILITY

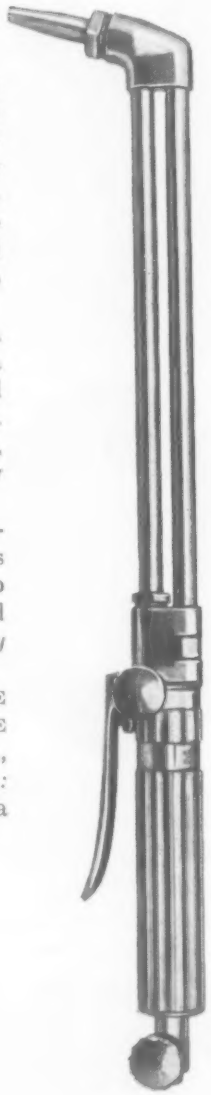
···you get more of both in the PUROX TRADE MARK "E" Cutting Torch

When LINDE first offered the PUROX "E" Torch to industry, Ford's model T automobile sold for less than $500. Today's average car costs at least 350% more. *But the price of the "E" torch has gone up only 22%.* Since practically every part in it has been refined for improved performance and longer life, the PUROX "E"—granddaddy of cutting torches—is still one of the biggest oxy-acetylene apparatus values to be found anywhere.

Whatever your present requirements, there's a PUROX "E" Torch to take care of them. Choose a head angle of 75, 90, or 180 degrees in standard 20½-in. length, or a 36-in. model with 90-deg. head. Should new or special needs develop at any time, any model can be adapted to meet them by simply replacing the front-end assembly.

With four interchangeable front ends and 57 different nozzles, the PUROX "E" Torch easily handles any practical hand-cutting job. It cuts steel up to 12 in. thick, washes pads, cuts rivets, gouges, and pierces. *And it performs efficiently on acetylene or any other commercial fuel gas available.*

See the PUROX "E" Torch today at your LINDE Distributor's. Or write for free folder, F-1313. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.



Linde Trade Mark

UNION CARBIDE

The terms "Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Morgan

McEvilly

Linde Co., New York City, has announced appointment of *D. W. Morgan* as manager of the Essington Electric Welding Apparatus Factory, Essington, Pa. He was previously assistant manager, Tonawanda (N. Y.) Factory.

Jerry McEvilly has been appointed a field representative for Arcair Co., Lancaster, Ohio, in the Chicago area. His territory will include more than nine mid-western states.

Roper

Leach

Earl Roper is new southern factory sales representative for Sellstrom Mfg. Co., Palatine, Ill. He will cover Alabama, Florida, Georgia, Mississippi, North and South Carolina and Tennessee.

Austin F. Leach has been named manager of stud welding sales at Omark Industries, Portland, Ore. He was formerly with General Electric Co., Schenectady, N. Y.

John P. Coltman has been appointed eastern sales representative for Norris-Thermador Corp., Los Angeles. His office will be located in Middletown, N. J.

The M. W. Kellog Co., New York City, has appointed *Kenneth H. MacWatt* as manager of sales for the fabricated products division.

QUIK HEAT

up to 2200° F.

CLEMENTS

Cadillac

MODEL K

BLOWTORCH

Here's a big, efficient blowtorch for all kinds of heat treating and production processes — yet it is completely and easily portable. Operates economically on either natural or manufactured gas. Produces heat up to 2200° F. in seconds! 1/3 h. p., Universal Motor. Sealed, precision ball bearings require no oiling. Equipped with metal stand, 10 ft. of gas hose and 20 ft. of reinforced rubber covered Underwriters' Approved cord with plug.

ask for **BULLETIN**

CLEMENTS MFG. CO.

6645 S. Narragansett Ave., Chicago 38, Ill.

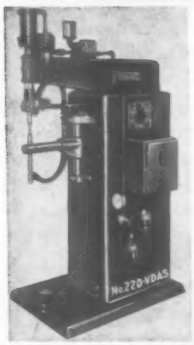
SINCE 1910

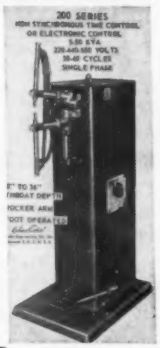
INDUSTRIAL PRODUCTS DIVISION

EISLER VERTICAL TYPE PRESS WELDERS

We also make a complete line of Spot and Wire Butt Welders.

Write for Cat. No. 93-57





EISLER ENGINEERING CO., INC.

Charles Eisler Jr., President

749 So. 13th St., Newark 3, N. J.

Brown

Henderson

Robert T. Brown, former sales manager of welding products for Metal & Thermit Corp., New York City, has been appointed general manager of the welding products division. Replacing Brown is *Nicholas Kiernan,* who will move to the firm's Rahway, N. J. office. *Otis Young* replaces Kiernan as regional manager in East Chicago, Ind.

Joe B. Henderson, Jr. has been named as an application engineer by Wall Colmonoy Corp., Detroit. Henderson will work out of the company's Houston, Texas district office.

McFeeters

Smith

Lincoln Electric Co., Cleveland, has named *E. Larry Smith* district manager of the firm's New York sales engineering district and *John H. McFeeters* manager of the Albany, N. Y. district.

Dexter G. Sherwood has been appointed assistant manager of marketing and advertising of the American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill.

Joseph M. Dorocke has been appointed general sales manger of Flood Safety Products Co., Chicago. In his new position, Dorocke will be responsible for an extensive expansion program.

Your "LINDE" Distributor WANTS TO HELP YOU... TO DO A BETTER JOB!

Your success is his success. As your business improves, his business with you increases. As your confidence in him grows, it benefits you both.

Your local LINDE Distributor offers a complete line of industrial gases, equipment, and supplies. He can satisfy almost any welding or cutting need *from stock.*

Difficult welding or cutting problems? See your LINDE Distributor. His technical background and experience, backed by Linde Company resources, can help get you on the right track quickly.

Talk with your LINDE Distributor today. As an independent local businessman, he is vitally concerned with your success. If you can't find his name in your telephone directory, write for it. Dept. 310, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde

UNION CARBIDE

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CUT BEVELING TIME BY 85% on Small Weldments

The PULLMAX Beveller can be used to bevel cut large size plates with proper table support and feeding arrangement. But where the PULLMAX Beveller really pays off is in small segments difficult to bevel cut by burning and grinding.

Bevel small plate in both straight and mild radius shapes at speeds up to 11 ft. per min.

			A	B
A	1 Cut	Mild Steel	½"	1"
B	2 Cuts	Stainless Steel	⅜"	¾"

Write today for literature and information

AMERICAN PULLMAX CO., INC. 2485 N. Sheffield Ave. Chicago 14, Illinois

SEE US, BOOTH 805, WELDING SHOW, APRIL 26-28, LOS ANGELES

"We, of Coyne Cylinder Company, sincerely hope you will visit booth 505 at the AWS Welding Show in Los Angeles, because nothing else tells our story better than your 'seeing for yourself' the outstanding investment value built into every Coyne Acetylene Cylinder."

"To make your visit with us even more helpful and informative please let us send you our literature in advance of 'show time.' Write or call now!

COYNE cylinder company

224 Ryan Way, South San Francisco, California. PLaza 6-6910
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24 Commerce Street, Newark, New Jersey. Mitchell 2-1618

Surmacz

Drewery

Harnischfeger Corp., Milwaukee, Wisc., has promoted *Joseph Surmacaz* to plant manager, *David Drewery* to director of production and industrial engineering, and *Robert Over* to superintendent of machine shops, heat treat, salvage, and cut-off departments. Surmacaz and Drewery joined the firm in 1951; Over has been with it since 1942.

Over

Roberts

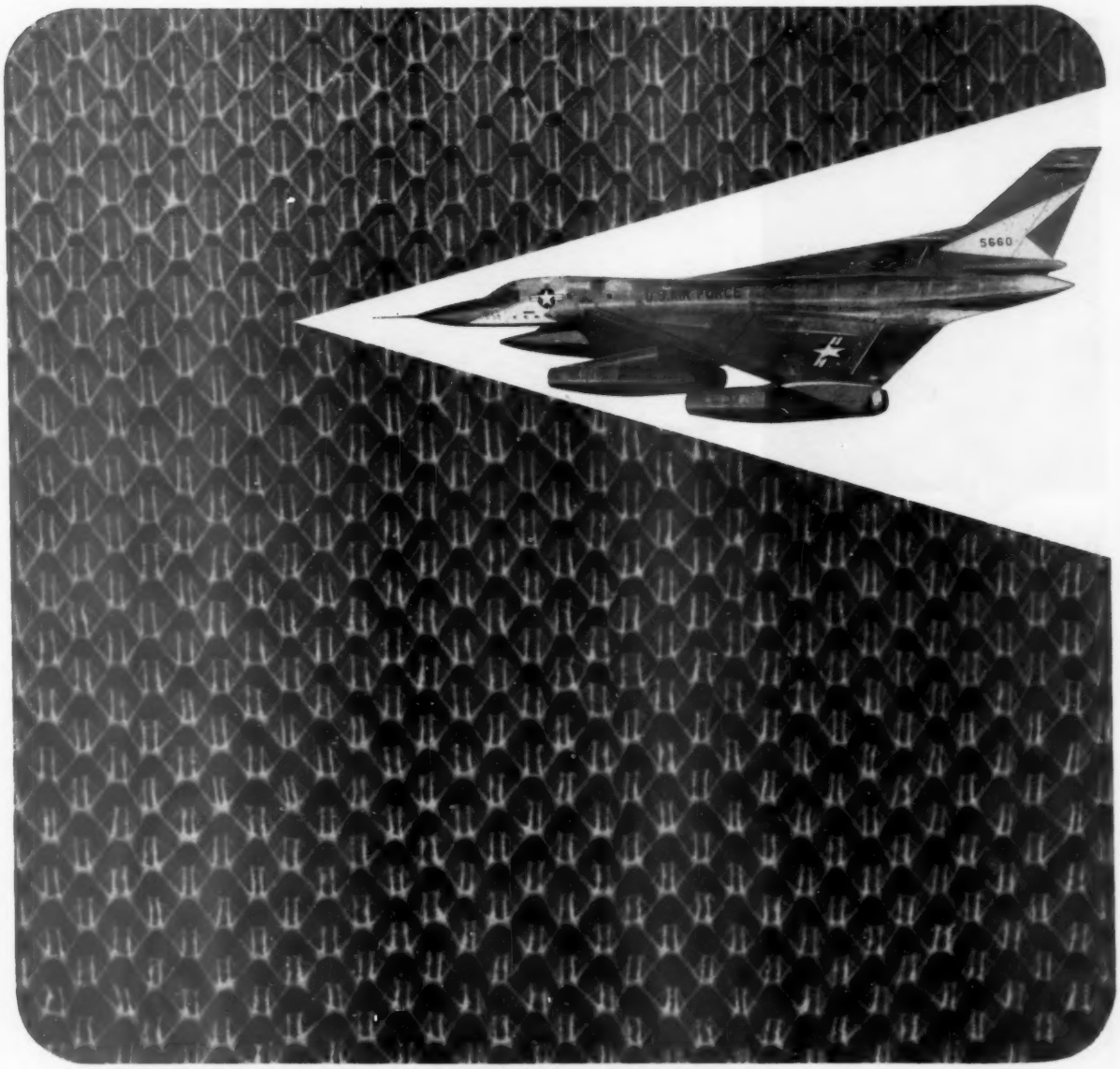
Phillip J. Roberts has recently joined Stulz-Sickles Co., Elizabeth, N. J., as district sales manager for metropolitan New York, New Jersey, and Philadelphia.

Died . . .

A tragic accident March 20 took the life of *Karl H. Schmuldt*, vice president of K-G Equipment Co., Allentown, Pa. Mr. Schmuldt and his teen-age daughter, Linda, as well as two other men were killed when their light plane crashed into an open field near Kingston, N. Y.

Schmuldt

Richard W. Whitton, 50, west coast sales representative for Sellstrom Mfg. Co., Palatine, Ill., died suddenly on Jan. 20. A native of South Dakota, Mr. Whitton had been with Sellstrom since 1956.



Gevaert X-ray films are used to inspect wing structure of Convair B-58 "Hustler."

GEVAERT STRUCTURIX X-RAY FILMS

.... *for proof of the product*

Quality-conscious industries rely on Gevaert X-ray films to assure product perfection. These films probe deep to search out hidden flaws, and their emulsion and base characteristics combine to define and separate the most delicate tones.

Gevaert Structurix X-Ray Film Types—

D-2: A unique slow-speed film of incomparable quality. D-2 gives by far the highest detail and finest grain available in any film. It is designed especially for rechecks and production inspection of thin or medium metal sections, and light metals.

D-4: A medium-speed fine grain film for inspecting medium thick or thick sections of light metals, and thin sections of heavy metals.

D-7: A high-speed film for inspection of medium to fairly thick light metals, thin and medium sections of heavy metals. Also for gamma radiography.

If you would like the details on all five Structurix Films, send for the free new booklet "Gevaert Industrial X-Ray Films."

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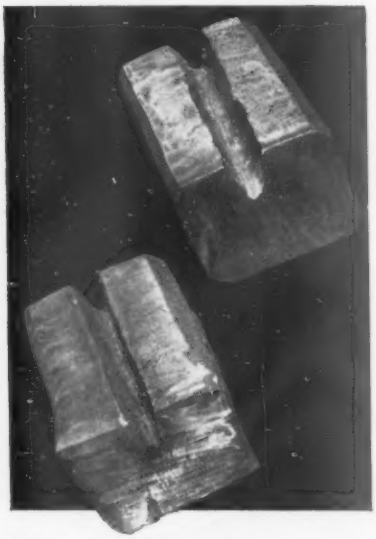


Which piece of 20 carbon steel was gouged in 26 minutes?

These two blocks of 20 carbon steel are 7 in. square and 8 in. long. The groove is 2¼ in. deep. The block on the right took 1¾ hours to chip out. The one on the left was gouged with an Arcair torch in 26 minutes — four times faster!

You can cut, gouge, bevel or groove *any* metal using the Arcair method — and get dramatic cost savings with an investment of much less than $100.

HOW DOES ARCAIR WORK? The torch utilizes air from an 80 p.s.i. air line, current from a welding machine and special electrodes to melt and remove metal. Fifteen minutes instruction is all an operator needs.

WHAT'S YOUR PROBLEM? Write us your specific problem. We'll give you a speedy and sincere answer.

Arcair

THE ARCAIR CO., 427 S. Mt. Pleasant St. Lancaster, Ohio

Send me more information on Arcair Torches and special electrodes.

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

MY PROBLEM_____

New products . . .

. . . use card on page 139

Oxygen unit

Transportable oxygen unit produces an unlimited supply of oxygen from the atmosphere and eliminates the usual heavy steel supply cylinders. Device draws air from the atmosphere, filters out contaminants, extracts oxygen and delivers the gas at approximately 5 psi. pressure in less than one minute after activation. Vibration does not affect the mechanism, company states. Prototype model is about two-ft. square and weighs 150 lb. *Aerojet-General Corp.*

Circle No. 1

E6013 electrode

General-purpose electrode cuts spatter loss up to 60%, improves manipulation to achieve operator acceptance of an E6013 class electrode. Designed for maximum versatility, electrode is expected to reduce the large number of rods of its kind, thus simplifying selection and storage problems. *A. O. Smith Corp.*

Circle No. 2

Portable nibbler

Air-powered portable nibbler weighs 12 lb., incorporates many safety factors. Operating on a punch and die action, device allows sheared pieces of metal to drop down and not be hurled upward; also, special construction makes it impossible for operator's fingers to come in contact with the punch. Nibbler has capacity to cut 3/16-in. copper, brass, aluminum, 10-gage stainless steel and 8-gage mild steel at a minimum radius of 6 in. Special adapter may be fitted for cutting a 3-in. radius on 12 gage stainless steel and lighter metals. Available in five styles. *Fenway Machine Co.*

Circle No. 3

200-amp welders

Series SGW-201 d-c arc welders are intended for general maintenance and repair. Compact gasoline-engine-driven units provide manual or electric starting with 200-amp 30-volt d-c output and either 120 or 240 volts a-c auxiliary power output. Models feature a special oversize welding and auxiliary power generator which is accurately balanced and blower-cooled. All models have two positive contact welding cable plugs with insulating sleeves, a duplex receptacle for a-c auxiliary power output, rigid tubular steel carrying frame with handles, a lifting eye covered by a hinged access door, dual mufflers, and starting rope sheave and rope. *National Cylinder Gas Div., Chemetron Corp.*

Circle No. 4

Engine generator

Company's 2,500 watt, 180-cycle engine generator incorporates idling control that saves up to 60% in fuel cost, extends engine life, and lowers maintenance cost, according to manufacturer. Tools are powered by a Briggs & Stratton 4-cycle engine. Maximum-minimum speed control is adjustable for best performance with low or high slump concrete. *Wincharger Corp.*

Circle No. 5

You can see many of these new products on display at the American Welding Society Exposition to be held April 26-28 at the Great Western Exhibit Center, Los Angeles.

Chemical dip

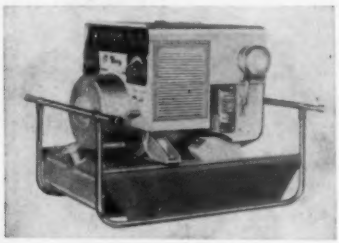
Chemical process completely eliminates all forms of electro polishing, machine and hand buffing, company states. Metal is immersed in dip and emerges with a mirror-like finish. No electrical current is involved in the process. Chemical is shipped in 15-gal. cubitainers. *Chemclean Products Corp.*

Circle No. 6

Coaxial ignitron

Coaxial ignitron will permit equipment builders to offer their customers means of reducing costly equipment downtime and interruptions of important production schedules, according to manufacturer. Coaxial cathode termination enables tube to control high-current, short-duration pulses without damage from magnetic effects. New tube can handle peak currents as high as 1,300 amp at peak voltages up to 1,800 volts, and may be used in a number of high peak current applications, including capacitor discharge circuits. *General Electric Co.*

Circle No. 7



Portable d-c welder

Portable d-c welder provides 3,500 watts of 60-cycle, single-phase a-c power for other purposes. Special generator design, incorporating start windings in the main generator, provides all models with inexpensive electric starting. Engine's generated d-c welding output is 200 amp, suitable for welding with E6010 and other electrodes common to field construction. Operator has continuous current control between main tap settings of 45, 55, 70, 85, 100, 115, 135, 155, 175, and 200 amp with a fine control that delivers exact heat for welds on any metal. Innovations in the redesigned welder include new lifting eye; enlarged air cleaner; twin muffler and manifold; two-speed, lever operated engine throttle control for a-c output; twin-power flywheel magneto. *A. O. Smith Corp.*

Circle No. 8

Flame-cutting machine

"Ultra-graph" guidance machine improves on normal flame-cutting quality, manufacturer states. Through use of an incorporated direct current power supply and transistorized control system, the device makes possible fabrication of complex items. Series 45 has an operating radius of 46 in. when folding arms are fully extended. Circles up to 42 in. in diameter and straightline cuts up to 91 in. can be cut. *Heath Engineering Co.*

Circle No. 9

Hardfacing wires

Hardfacing wires for suberged arc automatic applications are precision drawn to a tolerance of plus-minus 0.002-in., compressing the filler material to a near solid. One-hundred-lb layer-wound coils are covered with vapor producing, corrosion barrier paper, spiral wrapped with heavy asphalt laminated paper, and enclosed in a wax lined cardboard shipping and storage case. *Alloy Rods Co.*

Circle No. 10

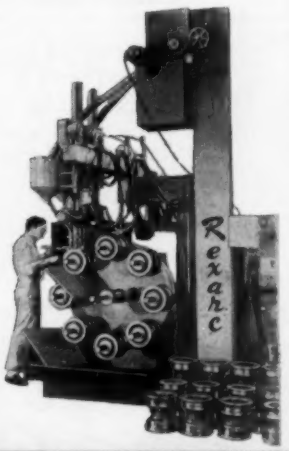
Force welder

Magnetic force welding machine for making full area percussion welds can be adapted to many operations requiring joining of non-ferrous metals. Designated Model APPAMFP-1-100-12, the unit is a 100 KVA machine with d-c holding coil delayed forge, diaphragm safety head, and selective micro-switch firing features. Electronic welding control is fully synchronous with selective half-cycle and positive and negative heat control features. *Acro Welder Mfg. Co.*

Circle No. 11

Revolutionary Rexarc

Enables high speed production rebuilding Rollers and Idlers



THE NEW REXARC MS-8 AUTOMATIC TWIN HEAD ROLLER REBUILDER—

has many outstanding features, power operated fully

The New Rexarc Automatic Flux Reconditioning System maintains automatically an adequate flux supply at all times eliminating manual flux handling—

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WELDING ELECTRODES, WELDER BRUSHES . . . Keen-Cut Electrodes for carbon arc-air jet cutting . . . Keen-Arc Carbons, cored and heavily copper coated, for twin-arc torches . . . paste, rods and plates.

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HMMMMM — SPOT WELDMENTS LIKE PERFORATED PAPER. THAT'S NEW!
BURN-THROUGH! WARPING! ALL KINDS O' TROUBLE, DOC! WHAT'M I GONNA DO?
NOW YOU JUST FOLLOW THOSE TUFFALOY CATALOG SUGGESTIONS, AND YOU'LL SEE A REAL IMPROVEMENT!

TUFFALOY COLD FORMED TIPS do a better job than forged or cast tips. But you weld better with *any* electrode when you follow the suggestions in the Tuffaloy catalog. It has information on tips, shanks, holders, bar stock, accessories and prices. Call your Airco or Tuffaloy office.

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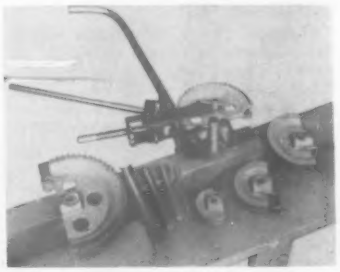
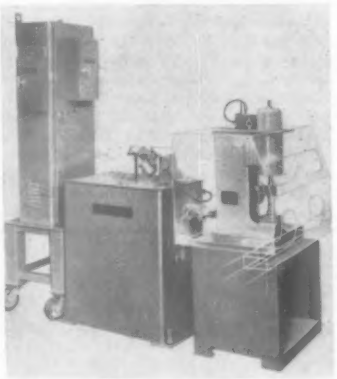


Bench bender

Bench bender has direct lever operation for bending soft copper and aluminum up to 1⅛-in. diameter, and for bending annealed steel tubes up to 1 in. OD. Device uses the "compression" type of bending which gives shorter radii without mandrel use and requires less hand power. Ratchet bending action for steel tubes to 1⅛ in. The two ratchet dies — 1¼ in. OD and 1⅛ in. OD — have cast-in ratchet teeth with ratchet lever attachment which gives one man the power of two, says *Wallace Supplies Mfg. Co.*

Circle No. 12



Force welding gun

Designed for welding semiconductors and other small electronic parts under controlled atmosphere conditions, the magnetic force welding gun fits easily into standard dry boxes. All air, water, and electrical supply lines are carried to the electrodes inside a hollow C-frame. Rugged frame and short throat maintain electrode alignment and surface parallelism. Connections are made to manifolds outside the dry box, so that no air or water can enter to contaminate the controlled atmosphere. *Precision Welder and Flexopress Corp.*

Circle No. 13

Pneumatic nibbler

Compact pneumatic nibbler cuts sheet metal up to 13 gage stainless steel without distorting or curling. Lightweight, air-powered unit is designed for safety and efficiency, says manufacturer. *Modern Mfg. Co., Inc.*

Circle No. 14

Self-study course

Packaged, self-study training course contains three comprehensive textbooks and all parts, materials and supplies needed to perform lesson exercises. Should prove useful to manufacturers for establishing in-plant brazing classes. Course is based on the curriculum of the three-day brazing class conducted monthly by Handy & Harman. All parts, alloys, fluxes, and other materials are packed in a 12 x 12 x 2-in. heavy cardboard box. Alloy calculator for determining the amount of alloys required for a given joint, and a pocket-sized fundamentals reminder card are enclosed. One complete course is priced at $25, F. O. B., New York. *Handy & Harman.*

Circle No. 15

Cylinder valve

Less than 4-3/16 in. in overall height, cylinder valve has low silhouette body design, is 20% lighter than older style valves. Series 850 has standard 1 1/8-in. wrench flats. Choice of outlets includes female CGA 581-591. Extra long 3/4-in. inlet is standard, while oversize, 1-in. and 1/2-in. inlet threads are also available. *Bastian-Blessing Co.*

Circle No. 16

Arc welding flux

Intended for single and multiple pass work at currents up to 1,200 amps, Autoflux H-400 submerged-arc welding flux has ability to sustain high travel speed with an x-ray quality deposit, say manufacturers. Typical physical properties when used with mild steel welding wire (.10 maximum carbon) are: yield (psi) 59,000; tensile strength (psi) 71,000, elongation 30%, and reduction of area 64%. *Hobart Bros. Co.*

Circle No. 17

Cycle counter

New device counts a-c cycles of weld time to an accuracy of plus-minus ¼ cycle, will count up to 127 cycles. Lightweight unit is battery operated, incorporates an automatic reset device in the circuit, so that the counter resets to zero after a count is completed. Circuit is completely transistorized to take rough handling. Induction pick-up is used to feed a signal to the counter, so that no clips, clamp-on coils or other connections are needed. *Instrument Control Co.*

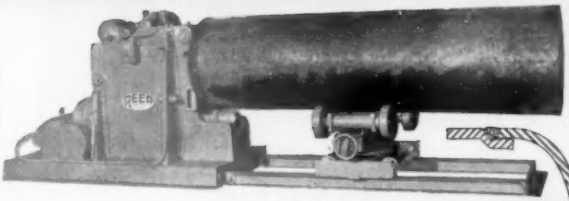
Circle No. 18

WEBB TANK PRODUCTION MACHINERY

Unit Type Turning Rolls

Portable Turning Rolls

Automatic Welding Track Supports

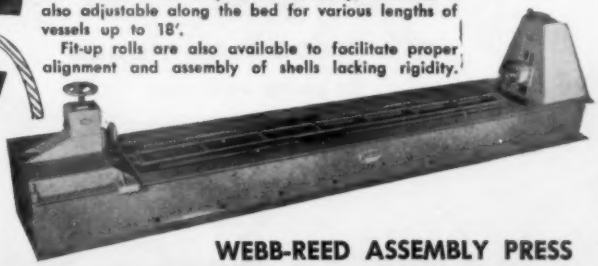


WEBB-REED OFFSETTER

This machine forms an offset flange around shell ends to facilitate automatic welding tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result. Three sizes of Offsetters handle up to ½" plate with standard dies. Illustrated with Turntable for reversing shell ends when both ends are to have offset flanges formed.

Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically; tailstock is also adjustable along the bed for various lengths of vessels up to 18'.

Fit-up rolls are also available to facilitate proper alignment and assembly of shells lacking rigidity.



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Horn Type Fixtures

Cylinder Flange Offsetters

Assembly Fixtures

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Job Report Courtesy of
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For peace of mind
on any stainless welding job

This vacuum separator, made of 5/16" Type 316 stainless steel, is designed for 100 psi test pressure. To assure *predictable* results, Arcos Chromend KMo Electrodes (Type 316) were selected for a *combination* of top physical, metallurgical and chemical properties. For maximum benefits in welding stainless—consistent quality, low cost weld metal, and reliability in service —you can count on ARCOS.

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for quality weld metal

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SEMI-AUTOMATIC AND AUTOMATIC EQUIPMENT FOR WELDING
STAINLESS • LOW ALLOY • ALUMINUM • MILD STEEL

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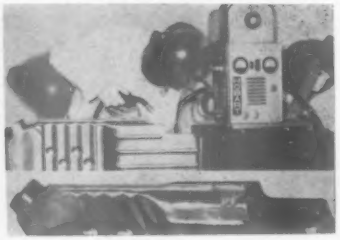


Micro-wire welding

New process for carbon-dioxide shielded arc welding of mild steel from 24 gage to ¼-in. thickness is claimed to possess high speed, minimum distortion, and little or no post-weld cleaning. Equipment includes a lightweight gun-cable assembly, a wire-feed unit, gas supply and regulation apparatus, and a power source of constant voltage or variable slope type. Small, 0.020 to 0.045 diameter weld wire is fed continuously from a spool into the weld zone. All wire feeding facilities, gas tubes and wires are contained inside one extruded cable jacket which measures ⅝-in. in diameter. *Hobart Bros. Co.*

Circle No. 19

Metal insulation

New system offers rapid, secure fastening of regular and high temperature insulation to galvanized duct-work aluminum ducts, industrial furnaces, refrigeration room facings, corrugated iron and steel plate. First, pointed pins are welded to the metal surface; then insulation is pressed onto the pointed tips of the pins; finally, insulating material is secured with push-on clips. *Omark Industries, Inc.*

Circle No. 20

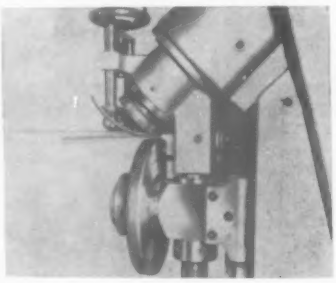


Plate beveller

Firm's model X-8 beveller cuts a ⅛-in. bevel on mild steel plate (or ⅝-in. on stainless) to prepare the seam for a perfect arc weld fillet. Users report up to 85% savings in bevelling time, company claims. Cutting speed on mild steel is approximately 11 ft. per minute. Machines are available in three models to cut 30-deg., 37½-deg., or 45-deg. bevels. *American Pullmax Co., Inc.*

Circle No. 21

Small tractor

Designed for use with company's ML-3 squirt welder, small, self-propelled tractor requires no guidance, simplifies fixturing, and will reproduce submerged arc welds at speeds from 7 to 70-in. per minute. *Lincoln Electric Co.*

Circle No. 22

Spot welder

Press type, air-operated resistance spot welder has roller bearing guided ram of hollow construction, hardened semi-steel and jig ground. Ram is lightweight to minimize inertia and provide rapid follow-up on any welding condition. Four ground surfaces provide running surfaces for eight anti-friction bearings. Rigid, cast semi-steel head support is horizontally keyed and securely bolted to, but insulated from, the upper head extension of the frame. *Taylor-Winfield Corp.*

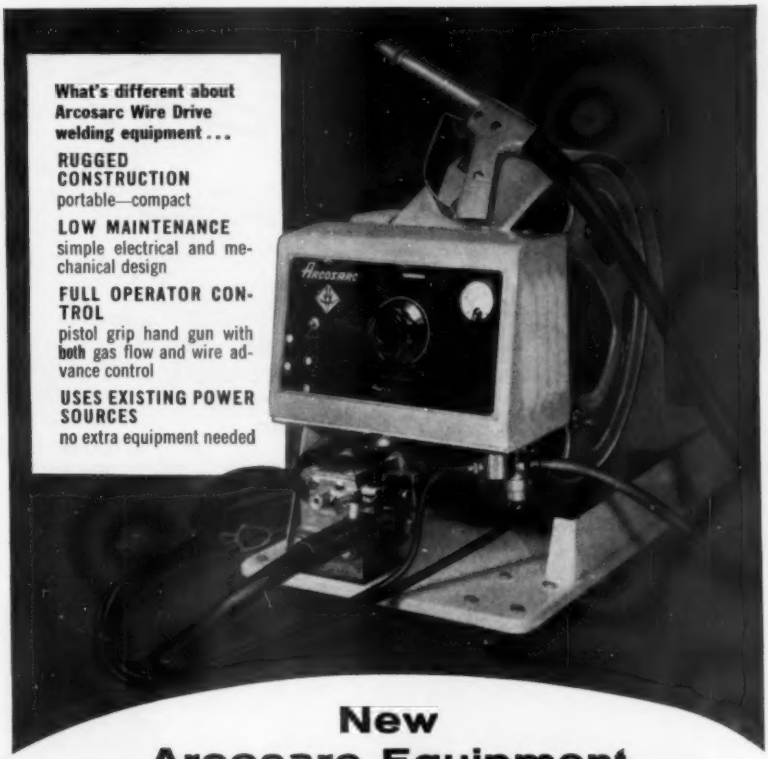
Circle No. 23

Safety hats

Safety hats and caps are available in choice of fibre-glass, aluminum and plastic, covering a full range of standard colors. New contour-fit suspension has been achieved by pliable polyethylene design. Lock straps assure minimum crown clearance of 1¼ in., which can be increased if desired. Numbered snap-in adjustment provides quick, easy fitting to any head size from 6⅝ to 8. Plastic-zippered sweat band can be taken out and replaced without affecting suspension. All models exceed federal standards for hard hat safety. *Bausch & Lomb Optical Co.*

Circle No. 24

You can see many of these new products on display at the American Welding Society Exposition to be held April 26-28 at the Great Western Exhibit Center, Los Angeles.


What's different about Arcosarc Wire Drive welding equipment . . .
RUGGED CONSTRUCTION
portable—compact
LOW MAINTENANCE
simple electrical and mechanical design
FULL OPERATOR CONTROL
pistol grip hand gun with both gas flow and wire advance control
USES EXISTING POWER SOURCES
no extra equipment needed
Arcosarc

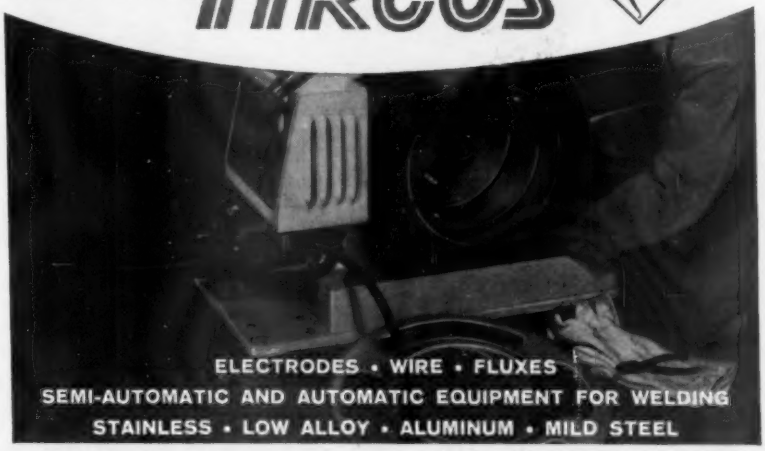
New Arcosarc Equipment

—for CO_2 welding of Mild and Low Alloy Steels

—for inert gas welding of Aluminum and Stainless

Here is a "bonus producing" wire feed unit for a variety of welding jobs in pipe, pressure vessel, structural steel fabricating shops, and foundries. Full instant control in the hand gun of the wire feed and gas flow along with the open arc give the welder the fullest opportunity to produce high quality weld metal consistently. Continuously fed wire eliminates stub losses, and the inconvenience of start and stop procedures. For the welder, ARCOSARC equipment improves manual operation; for the fabricator, it helps to keep costs under control.

WELD WITH ARCOS



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SEMI-AUTOMATIC AND AUTOMATIC EQUIPMENT FOR WELDING
STAINLESS • LOW ALLOY • ALUMINUM • MILD STEEL

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They mean National Carbide's calcium carbide —gets ten tests!
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Do it the easy way...

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★ NOT NECESSARY TO CHUCK THE PIPE
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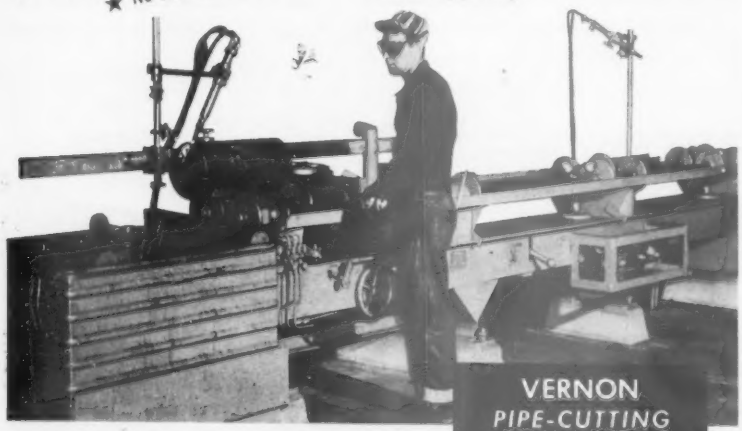
produce straight or beveled cut-offs, saddle and insert-type tee intersections, lateral intersections and miters with this easiest-to-use "one-man pipe shop"



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• Extremely simple to operate—no special skill required • Handles any length pipe—2" to 42" O.D. • No layout or templates required • No hand trimming—all cuts are smoothly finished and beveled • No chucking required • Makes uniform cuts on production runs • One-man operation • Machine can be portable—adaptable to any current

Write for Bulletin No. P-10

VERNON TOOL CO. LTD. 1101 MERIDIAN AVE., ALHAMBRA, CALIF.

Wire cutting

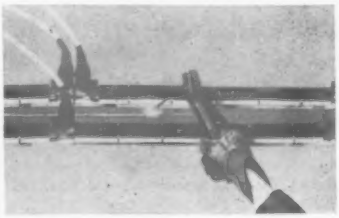
Firm claims its torches quickly cut wire cloth and expanded metals of any weight or alloy. Using an inexpensive electrode, torch will cut these materials at speeds of 48 in. per minute. Heat input to metal is much lower than with flame cutting, eliminating problem of changing the structure of the metal. *Arcair Co.*

Circle No. 25

Gas burners

Recently introduced gas burners include model TK-40-A, rated 1,250,000 BTU at 30-lb. pressure and model TK-150-A, rated at 2,000,000 BTU at 30-lb. pressure. Also available is model TK-10, a large vapor gas burner. *Wemco Products.*

Circle No. 26



Strip heater

Economical preheat of low-alloy high-tensile steels to prevent underbead cracking is facilitated by a "building block" electrical strip heater. Advantages claimed for new system include better weld quality through close, continuous control of heat input to base metal and elimination of cold spots; complete protection of personnel and equipment against accidental contact, overloading, mechanical abuse, and water damage; and fast, simple installation and removal of system units. Interchangeable plug-in units can be readily added or removed as job requirements change. Each block has output receptacles for as many as four spiders, each in turn serving up to three heater units. *J. B. Nottingham & Co., Inc.*

Circle No. 27

Carbon-arc burner

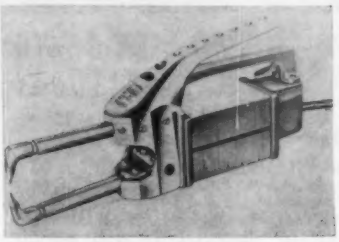
Easily carried in a mechanic's tool box, carbon-arc lead burner was designed for making emergency, on-the-job repairs to industrial storage batteries and for general heating jobs. Equipped with a pencil-tip carbon heating rod to melt the lead, the burner can also be used with chisel-point heating rods — easily interchanged by squeezing the lever of a spring clamp — to weld terminal-post seal rings found on stationary-type batteries. Designed for operation on 6-volt direct current, burner operates from three series-connected lead-acid cells of the battery being repaired or from an ordinary 6-volt automotive battery. *Electric Storage Battery Co.*

Circle No. 28

Die tooling

New tooling design elimniates need for handling dozens of bolts or for painstaking realignment. Die is "floated" in a bronze bushing fitted in the magnesium or aluminum table. Bushings are machined for a running clearance but hold close concentricity tolerances for precise work, manufacturer claims. Welding current is carried by the die itself contacting a conductor pad beneath the indexing table. Self-aligning arrangement uses slide positioning bars to keep die from rotating. *National Electric Welding Machines Co.*

Circle No. 29



Spot welders

Portable spot welders are intended for operations on sheet metal or wire, weigh 24 lb., and operate from 115 volts and 230 volts a-c respectively. Design features a tip tong which permits one-hand operation of the unit. *Metal & Thermit Corp.*

Circle No. 30

Tempering process

Tempering process is said to increase both strength and reliability of the strongest of alumium-magnesium alloys. Process makes possible two new tempers, designated -H323 and -H343; both assure maximum resistance to stress corrosion for sheet in alloys 5456 and 5083. *Aluminum Co. of America.*

Circle No. 31

Power rectifiers

Manufacturer's style 10 silicon diode is mounted in an axial, lead top hat, all welded case, was designed for general purpose applications up to 1.6 amps. Style 11 features low reverse leakage currents for special applications. Styles 22 and 23 are stud mounted revisons of the styles 10 and 11 respectively, employing a 7/16-in. hexagonal base. Peak inverse voltages range from 100 to 400 volts. The single cycle peak surge current rating is 20 amps for all diodes. *Syntron Co.*

Circle No. 32

Flow indicator

For flows down to 0.075 gpm (water) and ⅛ cfm (air or gas), simple indicator shows at a glance whether flow is taking place. Flow makes ball dance in glass dome; when flow stops, ball drops out of sight. Can be used in regulating cooling water to welding machine compressors. Made in ⅜-in. pipe size for pressures up to 100 psi with die-cast bronze body. *McIntosh Equipment Corp.*

Circle No. 33

on "tough" snagging and grinding operations . . .
. . . if PRODUCTIVITY is what you want!
PRODUCTIVITY is what you get!
with the
VEE-ARC
2 HP PORTABLE GRINDER
Clip Coupon and Mail Today!
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Tell me more about this Vee-Arc Portable Grinder:
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This NEW powerful but light-weight grinder does MORE WORK with less operator fatigue . . . DESIGN-ENGINEERED for use with 9" disc wheels . . . can be plugged into nearest 120-v. AC power outlet . . . LIFE-TIME LUBRICATED . . . TAMPER-PROOF SEALED . . . SIX MONTHS WARRANTY. All this . . . and more for only $168.00 f.o.b. nearest distributor.
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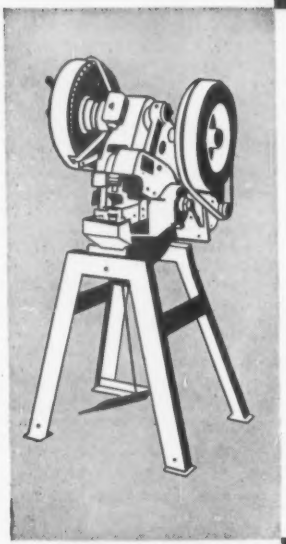
BANTAM
IRON WORKER



THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operater by Hand or Foot

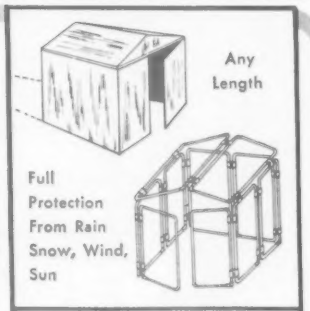
The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

WRITE TODAY for complete information and name of nearest distributor

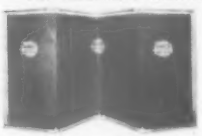
BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

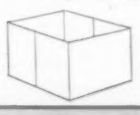
NEW
HANDI-HUT
FROM STANDARD
SERIES "60"
PORTO SCREEN
PANELS
FOR WELDING IN THE FIELD



HANDI-HUT SECTIONS CAN BE USED FOR —

Welding Screens,
Fire Screens, Windbreaks


Room Dividers


Wrap-
Around
Screens

Low-cost protection in minutes for production or maintenance welding. Porto-Screen panels make a complete Handi-Hut . . . or, you can use individual panels in many combinations for hundreds of everyday applications. Entire assembly folds compactly for storage or transporting, assembles without tools, is lightweight and durable.
In standard sizes 6' x 6' x 7' high and 12' x 6' x 7' high. Choice of fabrics.

Write for illustrated literature, prices, and name of nearby distributor.

FROMMELT

Tig welder

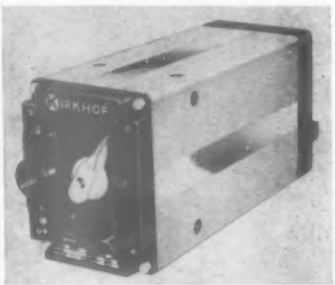
Balanced wave Tig welder is claimed by manufacturer to possess perfect balance throughout the entire welding range, even during crater elimination, and arc stability without high frequency at as low as 18 amps. Voltage reducer automatically lowers the open circuit voltage when arc is struck or broken. Range control switch plus infinite fine adjustment rheostat control for each of five ranges are on panel. Hand or foot remote controls are optionally available. *Miller Electric Co.*

Circle No. 34

Welding screens

Portable welding screens are available in four-panel models, providing complete enclosure and protection on four sides, and in triple- and single-curtain models. Frames are constructed of 1-in. tubular steel with a durable rust-proof black oxide finish. Curtains are held in place by sturdy lacing through heavy metal grommets. Legs raise the screen 3 in. off the ground for ventilation. *National Cylinder Gas. Div., Chemetron Corp.*

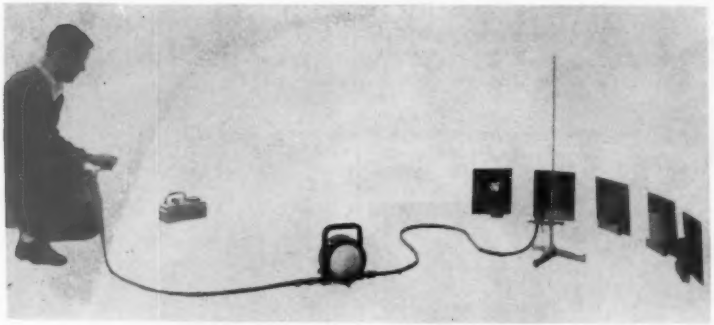
Circle No. 35



Welding transformer

Epoxy insulation on line of welding transformers makes 110 C rise completely safe and practical for high production welding, says manufacturer. Units are said to give from 17% to 30% extra in useable thermal capacity with the higher ratings. Rap switch assembly and secondary pad housing are formed of high-impact, fiberglass-reinforced polyester. Transformer measures 9¾-in. in height, 7½-in in width, 21-in. in length. *Kirkhof Manufacturing Corp.*

Circle No. 36



Gamma radiography

New line of radiography equipment utilizes radioisotopes cobalt 60, iridium 192, cesium 137 and thulium 170 in nondestructive testing of metal castings, parts and weldments. Fourteen basic machines are offered, with a variety of mounts. All machines may be obtained with more than one source position, permitting the use of two or more sources with different radiographic properties with the same unit. Most of the equipment may be used for panoramic exposures, where the source is exposed in the center of a group of specimens. *Radiation Engineered Services.*

Circle No. 37

Electro-magnetic valve

Small, electro-magnetically operated valve meets demand for a small control valve which will give electrical remote control of liquids and gases at low pressure. Instrument can be used to measure off accurate amounts by using an adjustable timer. With inert-gas welding, it can be arranged automatically to commence the argon flow just before welding begins and shut off gas when the run is finished, thereby preventing wasteage. Suitable for pressure of approximately 10 psi, or 4-in. mercury vacuum, the valve is available unmounted or mounted on a 4-in. x 6-in. bakelite baseboard with dust cover. *Milo Mfg. Co.*

Circle No. 38

You can see many of these new products on display at the American Welding Society Exposition to be held April 26-28 at the Great Western Exhibit Center, Los Angeles.

Induction heater

Dual frequency 10 kw output induction heating unit was specially designed for research and development work and for production of semi-conductor and other conductive materials. Unit has a totally enclosed cabinet with a gasketed door for dust and fume protection. Entire unit is mounted on heavy channel iron skids, and overhead cross members are available for lifting. Power input is 230/460 volts, 3 phase, 60 cycles. Water consumption, at full load, is 6-7 gpm at 80 F. Oscillator tube, tank coils, tank capacitors, and work coils are water cooled. Three meters for monitoring oscillator tube plate current, and plate voltage are mounted on the front of the cabinet. Net weight of entire unit is approximately 2,150 lb. *Lindberg Engineering Co.*

Circle No. 39

Drum welder

Low-cost semi-automatic utility unit mash seam welds containers in a range of sizes from 14 to 22-½ in. in diameter and up to 40-in. long. A single operator can turn out up to 250 55-gallon drums an hour. Flexible band clamp, housed in a travelling fixture, completely encloses and contains the periphery of the work. Use of the flexible band results in a narrower lap — as small as 3/32 in. — to reduce weld thickness, and insures proper containment of the drum during welding to eliminate splitting and pulling apart of the trailing edge of the seam. *National Electric Welding Machines Co.*

Circle No. 40

Announcing the arrival of our new addition

MODEL H
ULTRA-MATIC
ARC SPOT WELD GUN

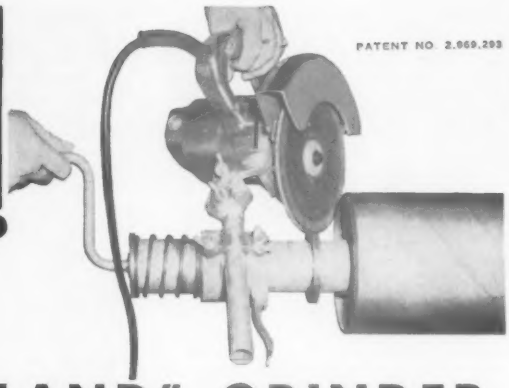
on display for your inspection
April 26th - 27th - 28th
welding show — los angeles, california

BOOTH NO. 520

your attendance is cordially invited. if you can't attend — please write for pictures and latest information

BREN WELD Corporation
MANUFACTURERS OF WELDING EQUIPMENT
5114 THIRD AVENUE • BROOKLYN 20, N. Y.

NEW!



PATENT NO. 2,869,293

H&M

"BEVEL-LAND" GRINDER

automatically cleans and lands pipe bevels

The new H & M "BEVEL-LAND" GRINDER employs an electric grinder to automatically clean and smooth pipe cuts and put the land on bevels. The machine may be placed on the pipe and in operation in less than one minute. A simple adjustment in angle of the grinding wheel is all that is required to change the machine from the cleaning to the land position. The H & M "BEVEL-LAND" GRINDER assures more postive alignment of pipe and better quality welds. The machine is available in two models: one for 6" to 14" and one for 14" to 36" pipe.

WRITE FOR YOUR COPY OF A CATALOG SHEET WHICH DESCRIBES ALL THE FEATURES OF THE NEW H & M "BEVEL-LAND" GRINDER.

H&M

TM Reg

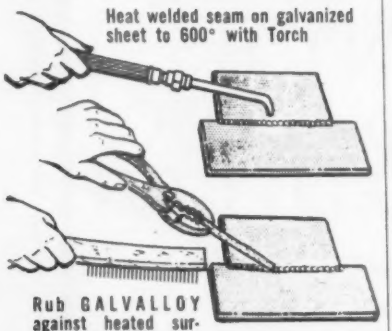
PIPE BEVELING MACHINE COMPANY

311 E. Third St. DI 3-0241

TULSA, OKLAHOMA

No Other Product Can Do a Galvanizing Job Like *Galvalloy* Does - *HERE'S PROOF*

Heat welded seam on galvanized sheet to 600° with Torch



Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

When You Weld Cast Iron Select the Correct

Fuse-Well

CAST IRON WELDING RODS OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

Utility torch

Propane fueled utility torches and torch kits can be used for soft soldering, paint burning, copper tube sweating, jewelry making, and general applications requiring heat. Features include instant self-starting, long burning, self-sealing valves, all-position burning, and disposable cylinders. *Air Reduction Sales Co.*

Circle No. 41

Stack assemblies

Series of over more than 125 silicon medium power rectifier stack assemblies offers ready-to-install packaged power rectifiers engineered to provide maximum output. Units span a current range from 1.5 to 14.4 amps d-c output, with a-c output voltages from 31 to 1,500 volts. Stacks consist of glass-to-metal hermetically sealed silicon diodes mounted on 1.56-in. copper cooling fins. Circuit configurations are single phase ½ wave, center tap, bridge and mag amp bridge; 3-phase ⅔ wave and bridge, and 6-phase star. *International Rectifier Corp.*

Circle No. 42

Flux remover

Flux removing compound quickly dissolves flux residues as a result of brazing or soldering. A dry powder which eliminates handling and toxicity difficulties of strong acids, compound, when mixed with water, works in matter of minutes and pickles the metal as well. *Bernard Chemical Products Co.*

Circle No. 43

Cleaning gun

Lightweight, handy needle gun is air operated. Reciprocating needles strike the surface being worked, cleaning, descaling, and derusting, particularly confined and inaccessible places. Model 1B weighs 3.3 lb., consumes only 4.8 cu. ft. per minute. *The Marindus Co.*

Circle No. 44

A-c welding machine

New design for a-c welding machine includes transformer laid on its side to make coil movement lateral rather than vertical. Cabinet height is reduced with no increase in floor space, to permit stacking up to three units. Improved 5-to-1 turning ratio has cut total handwheel turns from about 70 to 15. One-sided brake eliminates coil creep. Dimensions are 24-in. width, 30-in. depth, and 28-in. height. Handwheel-to-floor distance is 19¾ in. *A. O. Smith Corp.*

Circle No. 45

Improved fabricator

Firm's latest version of fabricating machine designed for punching, notching and nibbling features new electro-hydramatic head which contributes to the power stroke of the ram. This feature eliminates the need for pressurized air required on earlier models. Relatively simple electrically controlled solenoid valve replaces the air motor, air motor valve, linkage and piping formerly required. Machine punches round or shaped holes up to 3½-in. in diameter in any sheet metal (including printed circuit boards) up to ¼-in. mild steel. The change from single stroke punching to 165-strokes per minute nibbling is effected by a single toggle switch. Also featured are multiple-stop, side and back gaging. *Wales-Strippit, Inc.*

Circle No. 46

Rubber-bonded abrasives

Semi-firm rubber cushioned abrasive binder rounds out firm's line of such products. Four basic binders are now included in 49 stock compounds. In each there are six grain sizes from extra coarse to extra fine, and two grain types, silicon carbide and aluminum oxide. *Weldon Roberts Rubber Co.*

Circle No. 47

You can see many of these new products on display at the American Welding Society Exposition to be held April 26-28 at the Great Western Exhibit Center, Los Angeles.

NEW!
Improved Efficiency
SILVER BRAZING FLUX

KWIKFLUX
490

Improves Quality
. . . Cuts Costs!

Features:

- Greater Heat Tolerance
- Extreme Fluidity at Brazing Temperatures
- High Dilution Factor
- For Use from 1100° to 1700° F.
- Crystal Free

KWIKFLUX 490 contains all the refinements and know-how gained in over a quarter century of flux manufacture.

Prove it to yourself. Write on company letterhead for

FREE WORKING SAMPLE NOW!

SPECIAL CHEMICALS CORP.
100 SOUTH WATER ST., OSSINING, N. Y.

"DURO is the coolest"*

*says Ben Ruff of Reed & Graham, Inc. "Before I had to change holders whenever the one I was using would get hot. Now, with DURO, I can weld a whole shift without the holder getting hot to my hand, even when using 5/16 in. hardfacing electrodes at high amperages."

DURO will do the same for YOU
Proved by 28 years of welder's preference

- The Duro Electrode Holder has served the welding industry since 1932. It is famous for long life, positive grip and perfect balance. All parts are easily renewed. Semi- or fully insulated. Duro is available in 250, 300, 400, 500 and 600 amperes capacity.
- Cool operation — cool handling. Featuring "Long Jaw Design" for reaching those "hard to get at places."

THE DURO "STANDARD"

- Another feature is the square guard. It protects hands from heat and also prevents rolling and grounding when placed on a flat surface. There when you need it, is a hex key fitted into the brass core and held in place by the fiber handle for making fast cable connections.

DURO ENGINEERING COMPANY
31 OREGON AVE. • HAMDEN, CONN.

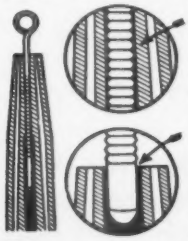
World's Finest CUTTING and WELDING TIP CLEANERS

WYPO
WIPES AND POLISHES

YOU GET SO MUCH MORE IN WYPO
Made of Stainless Steel

DOUBLES THE LIFE OF YOUR WELDING AND CUTTING TIPS

The exclusive circle design found only in Wypo Cutting and Welding Tip Cleaners provides as many as 60 more cleaning edges per inch of cleaner.



These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

This smooth pilot guides WYPO Tip Cleaner into tip Will not enlarge or damage tip port.

This cross section view of WYPO Cleaning Surfaces shows these exclusive features:

Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thoro cleaning by removing all waste.

SPRING LOADED SPOOL

Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

DOUBLE WOUND EYES

Insures longer life for small sizes of WYPO Tip Cleaners. Will not pull out of case.

NOW AVAILABLE IN 3 CONVENIENT SETS

WYPO TIP CLEANERS
STANDARD SET

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49

MADE IN U.S.A.
PAT. NOS. 2429581, 2473750 IN CANADA 1948

STANDARD SET OF (12) Cleans (27) Drill Sizes Nos. 75 to 49 Incl.

WYPO TIP CLEANERS
JUMBO SET

CLEANER NO.	FOR DRILL
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

MADE IN U.S.A.
PAT. NOS. 2429581, 2473750 IN CANADA 1948

JUMBO SET OF (9) Cleans (19) Drill Sizes Nos. 48 to 30 Incl.

MASTER SET
PAT. NOS. 2429581, 2473750 IN CANADA 1948
WYPO TIP CLEANERS

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

MADE IN U.S.A.

MASTER SET OF (21) Cleans (46) Drill Sizes Nos. 75 to 30 Incl.

Replacement cleaners available. Cleaning Range—Cleaner No. & Drill Nos. stamped on back of each case. WYPO GIVES YOU MORE!

SOLD BY LEADING WELDING SUPPLY DEALERS

MAITLEN AND BENSON, INC.
1395 Obispo St., Long Beach 4, Calif.

Magnetic seam tester

Magnetic particle welding seam tester transmits strong magnetic flux to the test area through one of two pole pieces. Capable of up to ¾-in. penetration, the instrument weighs only 24 lb. Paint need not be removed from test piece, as instrument does not damage coating of material under examination. When in use the device adheres to the steel, leaving the operator with both hands free. *Laboratory for Nondestructive Testing.*

Circle No. 48

Stabilizer

High-frequency stabilizer for inert-gas welding is designed for use with any standard a-c or d-c welder to convert it for inert-gas shielded arc welding on aluminum, stainless and alloy steels, copper, magnesium, and dissimilar metals. Built-in gas afterflow device reduces maintenance requirements by eliminating need for electronic timers. Unit operates from a 230-volt source and has a 0- to 600-amp capacity. *Metal & Thermit Corp.*

Circle No. 49

Automation welder

Machine automatically welds water heater shells at adjustable speeds up to 200 in. of weld per minute, eliminates hand operations of clamping, guiding of traversing welding head, unclamping and unloading from welder. Water-cooled back-up behind welds permits continuous, high speed operation without danger of overheating or creating material handling problems. *Leonard Precision Products Co.*

Circle No. 50

IT'S NEW: IT'S HANDY
IT'S ECONOMICAL

NEW "ROYAL" HARDENING POWDER IN THE NEW SHAKER CAN

- "ROYAL" Hardening Powder is more effective than cyanide. Gives off no dangerous fumes. Simplifies the work. Economical to use.
- Makes low-grade steel perform like high-grade steel.
- Enables the weldor or blacksmith to produce a finer cutting tool without technical equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large and small low-carbon steel tools and parts.
- Send for sample and descriptive booklet.

Manufactured only by:
ANTI-BORAX COMPOUND CO., INC.
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Never before! the *FIRST* **truly REVERSIBLE Welder's Glove**

NO exposed seams on EITHER SIDE!

PERFECT FIT on EITHER HAND!

FRONT and BACK LOOK ALIKE

PACKED SINGLY

Buy 3 instead of a pair. Can outlast 2 or 3 pairs.

It took 8 long years to design and perfect this truly interchangeable glove. Finest quality HORSEHIDE full fleece lined. Ask your dealer or write us.

SO DIFFERENT it's PATENTED!
(U.S. patent No. 2,617,109)

16 PAGE CATALOG
Complete line of work gloves, welding gloves and safety clothing.

SINGER GLOVE MFG. CO.
860 W. Wood St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DIRECTORY

Molded hats

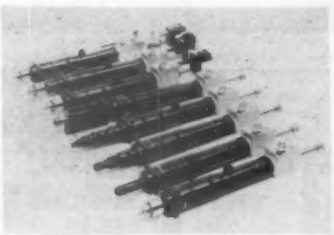
Lightweight and with no metal parts, injection molded plastic hats and caps are strong enough to withstand repeated 40 ft.-lb. impact tests. Molded lugs on the brim permit the attachment of chin straps. Snap-in suspension permits adjustment for head sizes 6½ to 7⅞, and adjustment of suspension on either side makes for added comfort. *Davis Emergency Equipment Co.*

Circle No. 51

Fusion arc unit

Spot gun has cold wire filler, tachometer feedback controlled motor, and automatic positioning and retracting of filler wire. Also featured in 1⅛ x 5⅛ x 6-in. unit are read-out speed indicator, water cooled, high frequency start, and pilot arc. Weight is 2 lb., 4 oz. *Weltronic Co.*

Circle No. 52



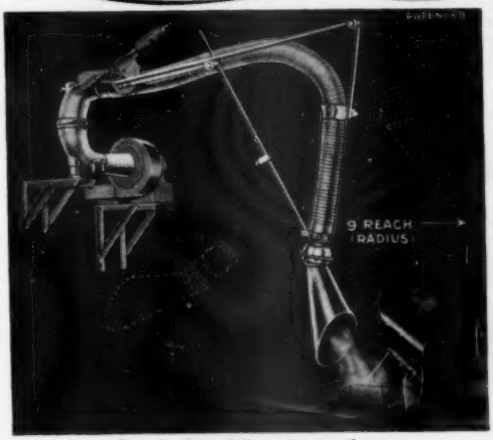
Automation tools

Series 21K and 21L of automation tools, combining the efficiency and economy of air motors and air cylinders, are useful in drilling, tapping, fastening, grinding, reaming, counterboring, and wire brushing. Firm's product produces linear as well as rotary motion, moving from fixed retracted position to the precise work spot. Length of stroke can be adjusted to micrometer accuracy over the 0-in. to 2-in. range by rotating the graduated external sleeve, then locking it in place. The 21K series is retracted by a spring return system, while the 21L is retracted by a double-acting air cylinder to preserve higher feed and/or retraction forces. Both series are available with standard heads that employ an integrated needle valve to control feed rate without affecting spindle rpm. *Buckeye Tools Corp.*

Circle No. 53

You can see many of these new products on display at the American Welding Society Exposition to be held April 26-28 at the Great Western Exhibit Center, Los Angeles.

"It certainly is a relief to have fumes and heat removed while I'm welding. The Ruemelin Collector has great suction. It makes a day's work pleasanter!"



Ruemelin Fume Collector in operation.

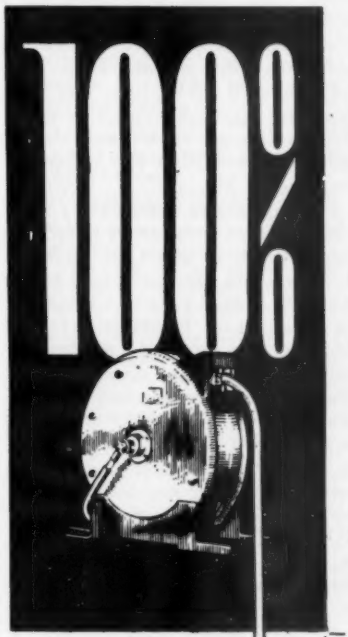
Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated at their source, thus improving working conditions, lessening fatigue and paving the way for increased plant production.

The Ruemelin Fume Collector hood can be instantly placed where needed anywhere in the booth welding area. No tedious adjustments necessary. Just pull the inlet hood to the welding position and you are ready to go.

Note the new spring-loaded counterbalance mechanism which makes Fume Collector much easier to handle. Ask for Bulletin 37-E illustrating this new feature.

RUEMELIN MFG. CO.

MANUFACTURERS AND ENGINEERS
SAND BLAST AND DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.



...100% of their cost in less than a year earned by WELD-REEL and REEL-KING Hose and Cable Reels in TIME-SAVING alone!

Savings in wear and damage under average shop conditions will raise the figure to 200%.
These automatic reels enable operators to coil up hose or cable—no slow uncoiling, no time wasted in unsnarling.
Stores hose and cable when not in use—protects from wear and from damage due to falling objects, kicks, sparks, cuts, trucks, etc. Service life has been increased as much as five times.

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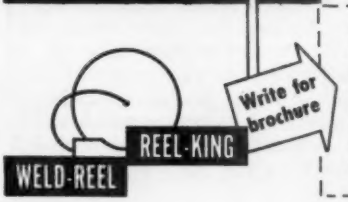

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Asbestos Welding Curtains

"Saf-T" By ALJAY

Pants, Aprons, Cape Sleeves, and Chaps for Weldors

No. 626 D. S. 26 Inch Coat Double Sleeve

- WELDORS GLOVES
- Chromed tanned Cowhide
- Soft and pliable
- Full cut
- Pearl grey or brown

- Double stitched
- Maximum comfort, wear and safety

No. 602 Cape Sleeve
No. 606 Pants

No. 627 Cape and Bib with Collar

- Riveted at stress points
- Packed in Poly Bags

New Price Lists and Catalogue Sheets Are Now Available Upon Request.

ALJAY MANUFACTURING CO.
1516 Callowhill St. — Philadelphia 30, Pa.

In 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding foundation—and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959 —23 YEARS LATER!

TIME PROVEN - MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

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Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐
Name ..... Address .....
City ..... State .....

Pipeline news

The Federal Power Commission has granted El Paso Natural Gas Co., El Paso, Texas, temporary authority to construct and operate gas pipeline facilities in Washington and Oregon at an estimated cost of $10,495,000.

FPC permission was granted to Tennessee Gas Transmission Co., Houston, to build field facilities at an approximate cost of $5,000,000.

Montana-Dakota Utilities Co., Minneapolis, has been authorized to build a total of about 15.5 miles of 6 5/8-in. line and approximately two miles of 4 1/2-in. field lines; a meter and regulator station; and dehydration facilities. Construction will be in Montana and Wyoming.

Coastal Transmission Corp., Houston, received permission to construct natural gas facilities during a period ending July 1, at a total cost not to exceed $1,000,000.

The FPC has granted temporary authorization to three companies to build gas facilities costing a total of almost $8,425,000. American Louisiana Pipe Line Co., Detroit, will build a compressor station in Louisiana and Tennessee. Mountain Fuel Supply Co., Salt Lake City, Utah, will construct 24.4 miles of 20-in. loop line in Utah, and Cities Service Gas Co., Oklahoma City, proposes to build 8.43 miles of 20-in. loop line in Franklin County, Kans.; 1.78 miles of 20-in. line in Cass County, Mo.; and 4.5 miles of 16-in. line in Johnson County, Mo.

Chicago District Pipeline Co., Joliet, Ill., has been given permission to construct about 50.1 miles of 36-in. main pipeline paralleling its Joliet-Calumet lines to Chicago.

Columbia Gulf Transmission Co., Houston, has received temporary authority to build and operate 41.1 miles of 24-in. pipeline loop at an estimated cost of $3,916,000. The line will begin in Vermillion Parish, La., and extend southeast to a junction with a gathering line in St. Mary Parish, La.

United Fuel Gas Co., Charleston, W. Va., will build 4.8 miles of 16-in. transmission line and 8,400 hp. in compressor capacity on its transmission system near Huntington, W. Va.

United Gas Pipe Line Co., Shreveport, La., will construct 8.72 miles of 30-in. pipeline paralleling a section of its system which will be submerged by a flood control project on the Angelina River in Texas.

Photo Courtesy The Lincoln Electric Co.

now . . .

ONE AMMETER for AC/DC WELDERS

Only **TONG-TEST** measures both AC and DC

Weld with confidence. Use the exact amperage — no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.

Write for Catalog WE-400

COLUMBIA ELECTRIC MFG. CO.
4551 Hamilton Avenue • Cleveland 14, Ohio

COMMANDO

ROUND SOAPSTONE HOLDER

- ★ SATIN-FINISH ALUMINUM HOLDER
- ★ HANDY POCKET CLIP
- ★ POSITIVE BUILT-IN CHUCK

Solid 7/16" aluminum construction. For ¼" round soapstone. Built-in knurled chuck positions and firmly holds soapstone. Complete with 5" stick of No. 1 select grade soapstone.

OTHER COMMANDO PRODUCTS

- ★ Replacement Drills
- ★ Lighters and Flints
- ★ White Metal Welding Rods
- ★ Goggle Head Bands
- ★ Ferrule Crimper
- ★ Tip Cleaning Drills

Buy at your local welding supply dealer

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J. M. EAGLE INDUSTRIES
2715 Oak St. • Kansas City 8, Mo.

Free literature . . . use card on page 139

75. INDUCTION HEATER — Induction Heating Corp. Flysheet IHN-12 describes company's induction heating machines for brazing, hardening and drawing. Diagrammed illustrations included.
76. ALLOY CHARTS — All State Welding Alloys Co., Inc. Tensile strength, recommended joining material, elongation and typical uses are shown for 24 aluminum alloys in series of charts.
77. LEAK TESTING — General Electric Co. Bulletin GET-2936, six pages, gives detailed instructions on use of halogen leak detectors for finding leaks in enclosures that can be pressurized.
78. ULTRASONIC CLEANERS — Curtiss-Wright Corp. Flysheet discusses cost, performance, and operation of firm's ultrasonic cleaning devices. Specifications included.
79. INDUSTRIAL SAFETY — National Safety Council. Multi-colored, 16-page pamphlet, "Who gets hurt?" uses humorous approach in discussing on-the-job injuries and accidents in general.
80. CONVERSION CHART — Precision Equipment Co. Reference table in form of wall chart includes common conversions such as inches to centimeters, watts to horsepower, microns to meters, centimeters per second to miles per hour, etc.
81. GAS TORCHES — Air Reduction Sales Co. Firm's complete line of gas welding and cutting hand torches is illustrated and described, along with specifications, in 36-page catalog.
82. ARC WELDING — Hobart Bros. Co. New 16-page arc welding supply catalog gives information on company's line of supplies and accessories including headshields, grinding shields, goggles, cleaning tools, electrode holders, ground clamps, etc.
83. CABLE CONNECTOR — Ampco Metal, Inc. Welding cable connector with patented locking action is described in brochure W-32.
84. HOSE REELS — United Specialties, Inc. Catalog folder describes automatic reels for hose and cable, both single and dual.
85. WELDING CABLE—Uniflex Cable Div., Gar Wood Industries, Inc. Bulletin UM-115 covers firm's line of resistance welding cable and secondary connectors, includes tables on cable performance.
86. FURNACE BRAZING — General Electric Co. Bulletin GEA-3193C, 50 pages, covers the where and why of furnace brazing, how to remove copper from steel after brazing, application and selection of brazing metal, selection of flux, etc.
87. HYDRAULIC PUMPS — American Brake Shoe Co. Comprehensive 72-page catalog No. 220 gives full design details and operating characteristics on firm's entire line of hydraulic pumps, fluid motors, and valves.
88. AIR COMPRESSORS — Allis Chalmers Mfg. Co. Selection of single-stage centrifugal compressors can be made with Bulletin 16B9485, which provides sizing procedure for company's standard B style close-coupled or overhung type centrifugal compressors up to 3.0 lb EAP and 150 hp.
89. SPOT GUN — Tec Torch Co., Inc. Folder No. TSG-1-TTCO gives description and specifications for Tig spot welding gun, including control unit.
90. TRACTOR RAILS — Rankin Mfg. Co. Four-page data sheet No. 102 gives step by step procedure, with diagrams, showing proper method of rebuilding tractor rails.
91. X-RAY UNIT — Balteau Electric Corp. Complete technical information on recently introduced portable X-ray unit is included in flyer.
92. POLISHING WHEELS — Nu-Matic Grinders, Inc. Catalog completely describes firm's line of inflated polishing wheels and expanding polishing drums.
93. SPOT-WELD CONTROL — Budd Co. Folder depicts and describes firm's "Monautronic V-2" welding control unit; specifications included.
94. BACKING RINGS — Robvon Backing Ring Co. Bulletin No. 56-2 describes complete line of backing rings available in carbon steel, wrought iron, chrome alloys, stainless steel, and aluminum.
95. THICKNESS TESTER — Branson Instruments, Inc. Eight-page bulletin A-200 details operation and specifications of two portable thickness testers operating on ultrasonic principles.
96. FILM COATING—American Solder & Flux Co. Company offers additional information on its "Drygalv," a flat gray film coating of 95% metallic zinc, used for protection of all metal treated surfaces.
97. ELECTRON BEAM WELDING — Hamilton Electrona Inc. Illustrated color folder describes and discusses various applications of electron beam welder.
98. MULTI-ARC WELDING — J. B. Nottingham & Co., Inc. Technical and economic significance of recent developments in multi-arc welding are highlighted in illustrated bulletin, and table summarizes comparative costs involved in multi-arc systems.
99. HOSE HANDLING — Clifford B. Hannay & Son, Inc. Fifteen page illustrated bulletin discusses applications of industrial hose, including welding.
100. AIR GUN — The Marindus Co. Leaflet describes and depicts needle air gun for use in cleaning, de-scaling, and de-rusting operations.
101. INDUCTION HEATING — Robotron Corp. Folder discusses advantages and lists features of firm's standard induction heating units.
102. FLOUROSCOPY — Philips Electronic Instruments. Illustrated, 12-page booklet discusses limitations and advantages of conventional flouroscopy, basic principles, preliminary investigations, pilot installation, production unit, and flouroscopic standards for mill control of weld quality.
103. CYLINDER TRUCKS — Harper Trucks, Inc. Specifications and general description of company's welding cylinder trucks are set forth in flyer HTW-3.
104. SAFETY TOOLS — Ampco Metal, Inc. Non-sparking safety tools are described in catalog, including channelock pliers, adjustable end wrenches, air hammer chisels, other standard tools.
105. MULTIPLE BENDER — Taylor Winfield Corp. Folder No. 601 gives information about company's metal forming and handling machines and electric welders.
106. CO_2 WELDING — National Cylinder Gas Div., Chemetron Corp. Operating data for firm's "dual Shield" carbon dioxide process is contained in new brochure NH-636,, which includes automatic welding data and data for mild steel spot welding.
107. ABRASIVE BELTS — Carborundum Co. December, 1951, issue of The Abrasives' Workshop highlights use of abrasive belt grinders, describes belt machine that gives a 32-ft. or finer micro-inch finish to jet blades at a rate of better than one per minute.
108. DIESEL ENGINES — Caterpillar Tractor Co. Illustrated, 20-page reference catalog D942 covers complete line of firm's earthmoving and diesel equipment, including electric sets, controls, industrial engines, auxiliary equipment.
109. SEQUENCE HEAD. — Valvair Corp. Bulletin E-1A tells of universal timing sequence head providing delay up to 30 seconds on time-in, time-out or both.
110. GAS EQUIPMENT — Smith Welding Equipment Corp. Booklet catalogs company's line of gas welding, cutting and allied equipment.
111. CUTTING TORCH — Arcair Co. Grooving, cutting, bevelling, gouging and metal removing operations of Arcair torch described in leaflet.
112. SAFETY HATS — Apex Safety Products. Catalog sheet details fibreglass, aluminum and phosphorescent safety hats. Liners and sweat-bands are included.
113. GUIDANCE MACHINES — Heath Engineering Co. Four-page folder illustrates and describes operation of precision guidance machines used to convey cutting torch or welding head at a constant controlled speed in contour and straight-line operation.
114. CONTROL VALVES—United Aircraft Products, Inc. Valves for fluid flow and condition control are covered in new 8-page booklet No. 5911251.
115. WELDING SCREEN — Singer Glove Mfg. Co. Five-page circular features new portable welding screen that encloses the job on all sides.
116. PROMOTIONAL LEAFLET — Resistance Welder Manufacturer's Assn. Promotional brochure tells story of RWMA's service to industry and educational aids available to the welding industry.
117. FLEXIBLE INSULATORS —Mueller Electric Co. Full-color sheet gives complete information on new color ranges in flexible insulators for firm's clips.
118. COATING PROCESS — Wall Colmonoy Corp. Two-page data sheet No. 4.5 describes company's process for oxidation, corrosion and abrasion resistance.

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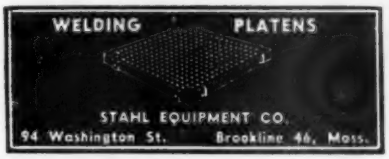

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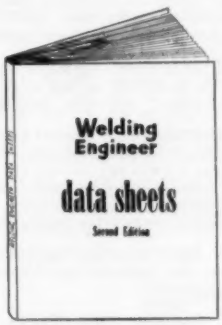

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151. Aljay Mfg. Co.—New catalogue sheets and price lists are available, on Aljay products.

152. Alloy Rods Co.—Detailed application information about "Atom-Arc" "T" in data sheet form is available.

153. All-State Welding Alloys Co., Inc.—Instruction manual to help you select the alloy and flux best suited for your job and an Aluminum manual on joining aluminum alloys available.

154. American Pullmax Co.—Literature available on the "Pullmax Beveller."

155. Ampco Metals Inc.—Bulletin RW-10 on welding dies of all types is available.

156. Anti-Borax Compound Co.—Descriptive booklet and sample of the new "Royal" hardening powder is available.

157. Arcair Co.—Further information on Arcair torches and special electrodes.

158. Bastian-Blessing Co.—Booklet on "Rego" cylinder valves available.

159. Bateman Foundry & Machine—Complete information on the "Bantam Iron Worker" and name of your nearest distributor.

160. Bay State Abrasive Products Co.—Write for further information on grinding wheels manufactured by Bay State.

161. Becker Brothers Carbon Co.—Catalog available on Becker "Keen-Cut" electrodes and other products made of carbon or graphite.

162. Branson Instruments, Inc.—Bulletin T-200 on Ultrasonic flaw detection further explains the new "Sonoray" model 5 pulse-echo type instrument.

163. Bren-Weld Corp.—Further information available on the new "Model H Ultra-Matic" arc spot weld gun.

164. Bridgeport Brass Co.—"Bronze Welding" booklet available.

165. Budd Co., Electronic Controls Div.—Complete details available on "Monautronic" control for resistance welding.

166. Budd Co., Nuclear Systems Div.—Write for bulletins on Gamma Radiography.

167. Cam-Lok Div., Empire Products, Inc.—Bulletin No. 301 on the complete line of Receptacles and Plugs is available.

168. Chicago Hardware Foundry Co.—Information on "Fuse-Well" cast-iron welding rods and electrodes is available.

169. Clements Mfg. Co.—Bulletins on "Clements Cadillac Model K Blowtorch."

170. Coast Metals, Inc.—Detailed information on hard facing welding rods, alloy castings and brazing powders.

171. Columbia Electric Mfg. Co.—Write for illustrated catalog on "Tong Test AC-DC Ammeter."

172. Contour Sales Corp.—Information available on "Curv-O-Mark" pipe layout tools for marking pipes and structural angle cuts of any type.

173. Cosa Corp.—Further information available on the "Copy Nibblers" precision machine tool manufactured by Cosa.

174. Coyne Cylinder Co.—Further details available on acetylene cylinders made by Coyne.

175. Dockson Corp.—Write for further information on Dockson's #545 outfit with welding torch suitable for all ordinary welding jobs.

176. Duro Engineering Co.—Additional information is available on the Duro electrode holders.

177. Eastman Kodak Co.—Write for further information on industrial X-Ray films and name of your nearest representative.

178. Eisler Engineering Co.—Catalog 93-57 on spot and wire butt welders and the vertical type press welder is available.

179. Electric Arc, Inc.—Further information is available in brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

180. Eutectic Welding Alloys Corp.—Information available on the "Low Temperature Welding Alloys" fluxes and welding aids.

181. Frommelt — Illustrated literature and prices on "Porto-Screen Panels" for welding in the field, also name of your nearest distributor.

182. Galv-Weld Products—Information and distributor franchises on galvanized welding and samples are available.

183. General Cable Corp.—Further information available on welding cable manufactured by General Cable.

184. Gevaert Company of America, Inc.—Booklet available, "Gevaert Industrial X-Ray Films."

185. H & M Pipe Beveling Machine Co.—Write for your copy of a catalog sheet which describes all the features of the new H & M "Beveland" grinder.

186. Handy & Harman—Booklet explaining silver brazing and its benefits is available.

187. Handy & Harman—Details available on the Handy & Harman Brazing Correspondence course to begin in November.

188. Harnischfeger Corp.—Bulletin W-155 on P&H time-amperage controls is available.

189. Harnischfeger Corp.—Further information on P&H engine driven welders is available in bulletin W-158.

190. Harrisburg Steel Co.—Write for additional information on gas cylinders manufactured by Harrisburg.

191. Harris Calorific Co.—Further information available on welding and cutting apparatus including the new Harris lightweight No. 42 cutting torch.

192. Heath Engineering Co.—Write for details on new models of "Ultra-Graph" flame-cutting machines.

193. Hobart Brothers Co.—Complete details available on the new "Microwire" welding process.

194. Hobart Brothers Co.—Further information available on Rocket 24 and Rocket 27 iron powder electrodes.

195. International Nickel Co.—Brochure available, "Now You Can Weld 97% of All Dissimilar Alloys Combinations with One Electrode."

196. Jackson Products—Write for additional information on Jackson's "Quik-Trik" cable connectors, ground clamps, and cable lugs.

197. Lenco, Inc.—Booklet, "Reducing Costs By Proper Care of Arc-Welding Circuits" is available.

198. Lennox Tool And Machine Builders—Complete information on the "Metl-Mastr" for shearing, forming and piercing.

199. Linde Co.—Write for full details on the "Oxweld CM-60" shape cutting machine.

206. Linde Co.—Folder F-1313 available on the "Purox" E cutting torch.

207. Liquid Carbonic Div., General Dynamics Corp.—Write for information on application of industrial gases, using "Liquidweld" apparatus.

208. Lukens Steel Co.—Write for Lukens Plate-Mate Technical Catalog.

209. Maitlen And Benson, Inc.—Information on "Wypo" cutting and welding tip cleaners.

210. Markal Co. — Literature and sample pellet of "Thermomelt" temperature indicators available.

200. The McKay Co.—Hard Surfacing catalog available giving data on repair and reclamation of over 500 specific parts of various types of equipment.

201. The McKay Co.—Manual available, "Earth Moving Equipment" gives detailed information for the deposition of alloys for the proper build-up or hard surfacing used for heavy earth moving equipment.

202. The McKay Co.—"The Welding of Stainless Steels" is a 48-page booklet on chemical analysis, mechanical properties, corrosion resistance and types of electrodes available for welding stainless steel.

203. The McKay Co.—Booklet, "The Welding of Mild Steels," explains operating characteristics of McKay mild steel electrodes.

204. The McKay Co.—A comparison chart available for matching brand name electrodes with other major manufacturers.

205. The McKay Co.—Also available is a Selector chart for the selection and use of McKay welding products.

211. Merrill Brothers—Catalog C-2 describes over 25 material handling devices manufactured by Merrill.

212. Messer Cutting Machines, Inc.—New brochure available describing Messer oxygen cutting machines and their advantages.

213. Metal & Thermit Corp.—Further information available on "M&T Murex" electrodes and their complete line of welding machines.

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214. Metalloy Products Co.—Testing sample of "Galvalloy" available for your galvanizing job.

215. Mid-State Welder Mfg. Co.—Further information available on silicon powered welders manufactured by Mid-State.

216. Miller Electric Mfg. Co., Inc.—Complete specifications on the new Miller AEA-200-L gasoline engine driven welder/power plant and folder, "How to Thaw Frozen Water Pipes" available.

217. Miller Electric Mfg. Co., Inc.—Form BW-3 explains the new Miller welder and its various features.

218. National Carbide Co.—Further information available on calcium carbide and name of your nearest distributor.

219. National Welding Equipment Co.—Write for further information on welding torches manufactured by National.

220. J. B. Nottingham & Co., Inc.—"Practical Preheat For High Performance Steels" available.

221. Page Steel & Wire Div.—Folder containing information on submerged arc and inert gas automatic welding wire and chart giving detailed analyses of automatic welding wires are available.

222. Phelps Dodge Copper Products Corp.—Information on Phelps Dodge "Habirprene" arc welding cable is available.

223. Philips Electronic Instruments—"Norelco Twin Focus" industrial X-ray equipment demenstrated on your equipment.

224. Picker X-Ray Corp.—Information on radography and how it can benefit you.

225. Pressed Steel Tank Co.—Prices and specifications on Hackney cylinders for compressed industrial gases.

61. Prest-O-Matic., Co., Inc.—Write for further information on the new automatic air-acetylene brazing torch.

226. J. M. Ragle Industries—Write for additional information on the "Commando" round soapstone holder and other "Commando" products.

227. Ransome Company—Write for further information on Ransome welding positioners.

228. Reid-Avery Co., Inc.—Write for additional information on precision welding rods and wires, manufactured by Reid-Avery.

229. Rexarc, Inc.—Complete information on new Rexarc autmatic flux reconditioning system.

230. Ruemelin Mfg. Co.—Detailed information on the Ruemelin fume collector is available.

231. Servospeed, Div. of Electro Devices, Inc.—Data on electronic engineering with precise motor speed control.

232. Shawinigan Products Corp.—Write for further information on calcium carbide and name of your nearest distributor.

233. Singer Glove Mfg. Co.—Catalog available showing complete line of work gloves, welding gloves and safety clothing.

234. A. O. Smith Corp.—Send for a free test sample of the SW-612 electrode.

235. Special Chemical Corp.—Write for a free working sample of the silver brazing flux, "Kwikflux."

236. Tec Torch Co., Inc.—Further information available on Tec "Visuweld" watercooled torch and other torches for tig welding.

237. Tempil Corp.—Additional data on "Tempilstiks" the temperature indicating crayons is available.

238. Titan Metal Mfg. Co.—Write for folder describing Titan welding rod compositions and uses.

239. Tuffaloy, Div. of Air Reduction Sales Co.—Tuffaloy catalog on tips, shanks, holders, bar stock accesories and prices, is available.

240. Tweco Products, Inc.—Further information on "Twecotong" holders with ball-point cable connection and a cable connection support is available.

241. United Specialties, Inc.—Brochure available on "Weld-Reel" and "Reel-King" hose and cable reels.

242. Vee-arc Corp.—Additional information on the portable grinder is available.

243. Vernon Tool Co.—Bulletin No. P-10 on pipe-cutting pantograph, is available.

244. Victor Equipment Co.—Information on cutting torches manufactured by Victor available.

245. Victor Equipment Co.—Write for additional information on "Ni-Mn" rods and a dealership.

246. Wallace Supplies Mfg. Co.—Booklet available, "The De Witt System of Joint Preparation."

247. Webb Corp.—Illustrated literature on tank production machinery manufactured by Webb.

248. Westinghouse Welding Div.—More information on the new WS silicon welder available.

249. Westinghouse Electric Corp.—A pocket size electrode selector booklet is available showing the new "Zip-10" iron powder-coated electrode.

60. Westinghouse X-Ray Dept.—Further information on "Baltospot" X-ray equipment available.

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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Name ..... Title .....

Company .....

Address .....

City ..... State 4/60

NOT GOOD AFTER JULY 1, 1960

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
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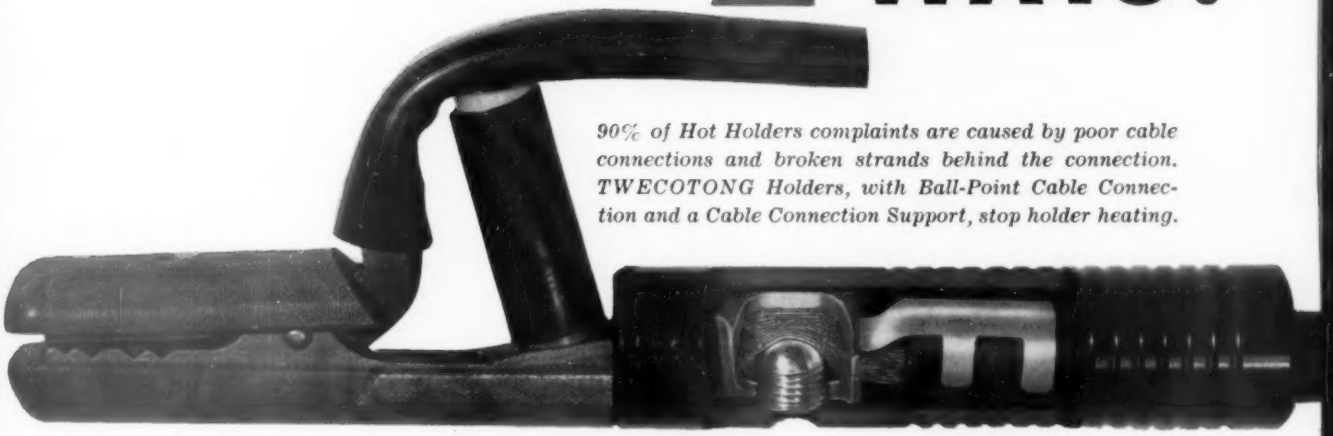
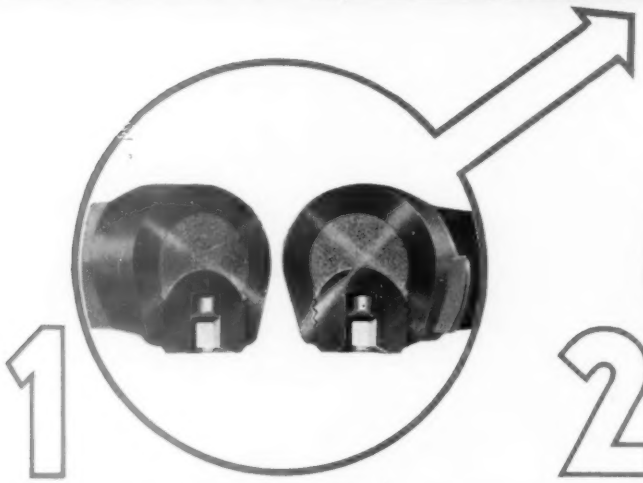
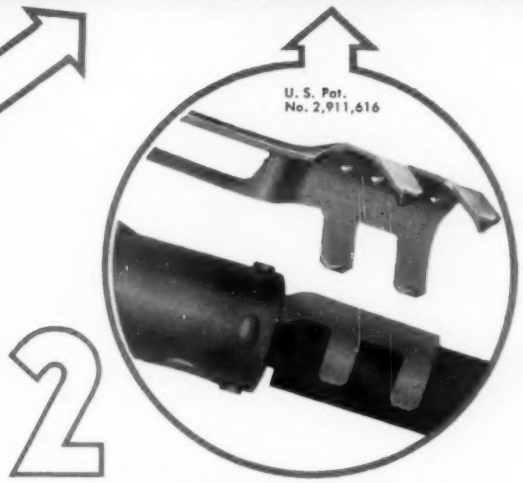
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

STOP HOLDER HEATING 2 WAYS!

90% of Hot Holders complaints are caused by poor cable connections and broken strands behind the connection. TWECOTONG Holders, with Ball-Point Cable Connection and a Cable Connection Support, stop holder heating.







TWECO'S Ball-Point Connection holds every strand under extreme pressure. Each strand carries current. Does not work loose. Holder can be installed on cable in less than two minutes using 7/32" hex wrench. Saves time — Saves money.

TWECO'S Cable Connection Support absolutely stops the movement of cable strands behind the cable connection. Strands can not break and cause heating. Also stops the cable jacket from slipping, exposing bare strands.

Tweco

MANUFACTURERS: ARC WELDING ELECTRODE HOLDERS, GROUND CLAMPS, CABLE CONNECTORS, TWECO-LITE ALUMINUM WELDING CABLE

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MILLER GASOLINE ENGINE DRIVEN WELDER/POWER PLANTS

MODEL AEA 200-L

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ELECTRIC MANUFACTURING CO., INC.

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This Miller AEA-200-L gasoline engine driven welder/power plant is a real "powerhouse" — delivers 225 amperes of high cycle welding current plus 1000 watts of 115v d-c while welding. In addition, it produces 5 KW of 115/230v a-c .

Driven by powerful 12.9 h.p. Onan air-cooled engine, the AEA-200-L is a rugged and reliable welder/power plant for use anywhere!

Electric starter and various wheel mounts available. Complete specifications and interesting folder "How to Thaw Frozen Water Pipes" sent promptly upon request.